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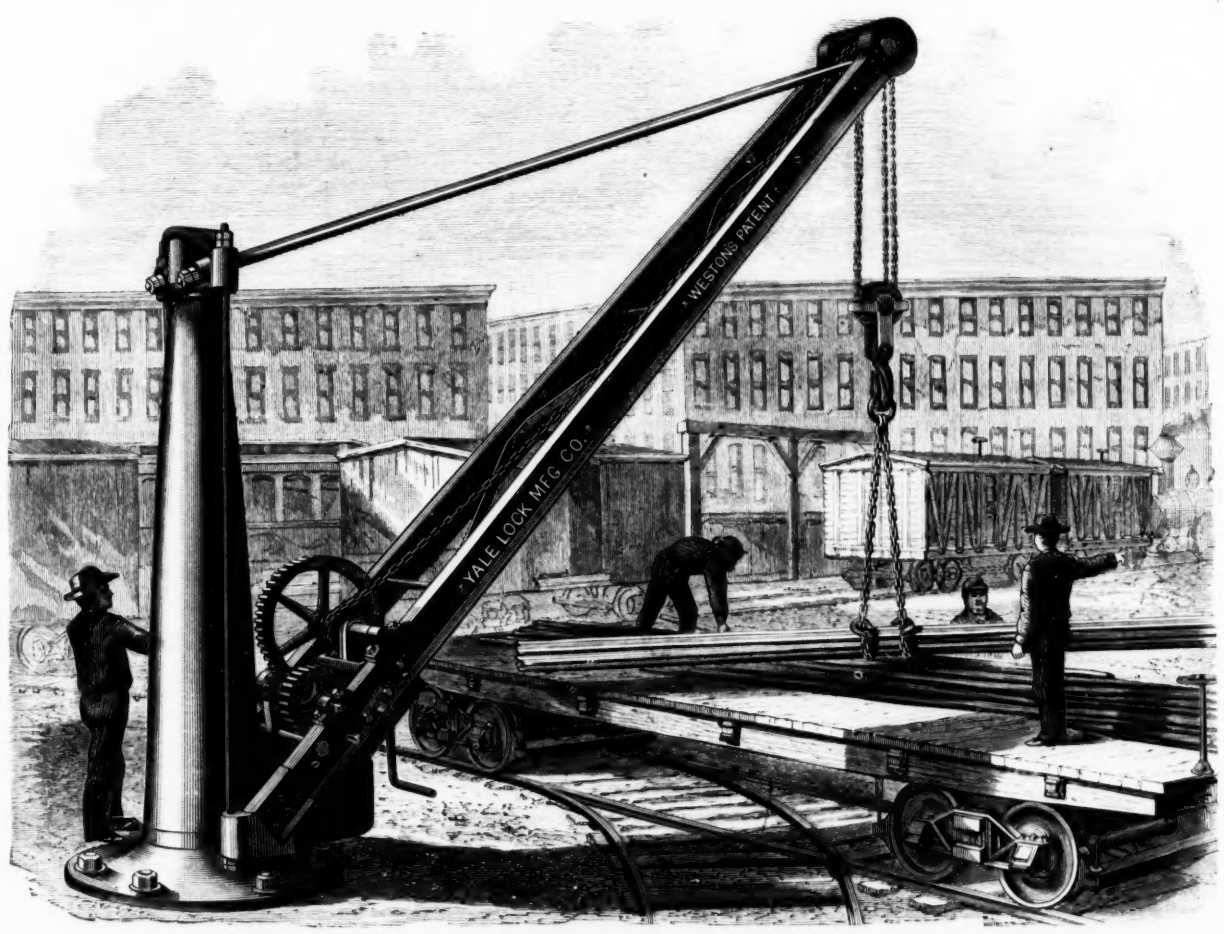
Pillar Crane for Railroad and Yard Work.

We present herewith an illustration of an improved pillar crane intended particularly for railroad and other yard uses, which is built by The Yale Lock Manufacturing Company of Stamford, Conn., under the patents of T. A. Weston, the inventor of the well-known differential pulley-block.

As shown in the cut, the crane consists of a heavy cast iron column, of peculiarly simple and symmetrical design, its shape being harmonized to the strains it is intended to resist and the architectural excrescences, which are so commonly engrafted upon iron work of this type are purposely omitted.

As the crane is supported entirely from its base, the column is provided with a very broad footing, through which the foundation bolts extend downward into and through the foundation masonry. The boom, which is formed of two wrought iron channel beams, is arranged to swing freely around the column, its foot being provided with two horizontal turned rollers which travel on a turned circular path around the base of the column. Fixed in the head of the column is a steel pin, upon which rests the cross head or yoke, which latter is bushed with bronze to form a bearing for the pin. The entire weight, both of the boom and of the load, is carried by the cross head, and the thrust is carried by the turned rollers above referred to. In this way the friction of rotation is reduced to a minimum, so that the crane can be turned with the maximum load suspended with the least possible effort. All wrought iron parts subjected to strains are proportioned with a minimum factor of safety of six, and the proportions of the details throughout are correspondingly large.



PILLAR CRANE FOR RAILROAD AND YARD WORK.

The hoisting and lowering gear, which is attached to the boom near the column, consists of a trench, provided with a self-acting safety brake, the construction of which is such that the handles cannot recoil on the operator nor the load "run away." This feature is of the utmost importance, both to the operator and to the load, and is an absolute protection against the accidents which so frequently happen with cranes of the ordinary type, and which arise from the operator losing control of the load, in which case the handles recoil violently, and damage inevitably results. With the safety brake, the handles may at any time be "let go," and the load will remain suspended. To lower it, it is necessary to turn the handles backward, the load descending easily and smoothly, so long as this motion is continued, but coming to rest, if the motion be stopped or the handles "let go." In order to "pay out" or "let down" the empty block quickly without any load, the pawl may be thrown out, in which case, the chain sheave and chain being free, can be overhauled rapidly as desired.

The regular sizes of these cranes have capacities of 2, 5, 10 and 15 tons, the radius of the boom being from 10 to 20 feet. Larger or special sizes are also made when required. Their distinguishing features are simplicity, convenience and entire safety, both in the operating mechanism and in the proportioning of the parts which are to resist strains.

Will it Pay?

Before engaging in any important business undertaking, the first question that suggests itself for consideration is, Will it pay?

If all individuals were constituted alike, and of the same mind, each would fully agree with the other. But, as this is not the case, each one has his own peculiar ideas of business economy. We will make a few comparisons. The business of a manufacturer has increased to such an extent that an enlargement of his facilities becomes an absolute necessity. He accordingly calls his superintendent, and inquires what increase of room and machinery is needed in the several departments to enable them to supply all demands. Afterwards an extra allowance is made for an expected enlargement of the business. Drawings are then made of the new buildings, with no extravagant waste of material. The frame work is to be carefully calculated, and the walls are to be amply strong for all contingencies.

Estimates are procured from the tool and machinery manufacturers, and all the other details which necessarily present themselves for consideration are taken up in their regular order.

The actual cost of the enlargement may now be calculated with a fair degree of accuracy.

After making any desirable changes, the contracts are given a reasonable time in advance to ensure obtaining the best-seasoned timber, as well as the first quality of all the other materials. Sufficient time is allowed the contractor to secure skilled labor, that the work may be prosecuted as rapidly as possible, yet done in a strictly first-class manner. The machinery is of the best, and no pains are spared in erecting the same, so that when the engine is put in motion everything works to the honor of the constructors.

Such is the course which would be pursued by the systematic, economical business man, who fully understands how to take true advantage of his opportunities. Other men, who may be just as sincere in their convictions of their ability to manage the requirements of their business, will never have any recognized system in conducting their affairs. If their business, fortunately, increases to the extent of requiring an enlargement, they allow the necessity to be neglected as long as possible, and the superintendent or foreman is not consulted, nor is his counsel asked for or allowed. We will take a case which happened not long since, in which it is to be understood that the proprietor did not comprehend as well as his superintendent what was required in the shape of tools and men to produce a given quantity of work. In neglecting to consult with his superintendent he not only shows by such conduct that he has no confidence in the executive ability of his subordinate, but the dignity of that individual (if he has the feelings of a true man) is touched at once, and he says to himself, "I see the old man knows more about it than I do, so he may take the entire responsibility of the work, and give his orders accordingly." So the superintendent quietly listens while the proprietor explains his ideas and tells what he is going to do, and when he has finished the superintendent goes away dissatisfied with his position, and feels deeply injured because his advice or co-operation was not asked for. No drawings are made of the buildings, but a builder is called in, and asked what he will lump the job for, and put up the buildings. A price is agreed upon, the work is begun at once and prosecuted with wonderful rapidity, and all kinds of green wood and other available materials are used until the work is finished. The market is then scoured for tools and machinery, and where a second-hand tool can be used it is adopted at once.

The shafting is put up in a hurry without proper alignment, and the machinery, when started up, is enough to bring tears to the eyes of any skilled mechanic. The pulleys run out of truth, the shafting is sprung, the countershafts have to be shifted, to make the belts run. The machines also have to be shifted, and the fact is, that so long as that shop stands, there will be trouble, on account of the proprietor's ignorance, and he will have the unspeakable pleasure of paying all the expenses.

This is not a supposed case, but one that happened not a thousand miles from this city, and figures already show that the repairs of buildings and tools, together with the losses of contracts for particular work, far exceed the cost of the best buildings. We do not advocate an extravagant waste of building material, where it will do no good, but the designs should be executed by persons who know just what they are about. If the superintendent of a shop is not to be consulted in such matters, he is incompetent to fill his position, and should be removed. If a proprietor properly appreciates a good superintendent, he will place power and responsibility in his hands, thus relieving his own mind, which will the better enable him to perform his own duties in the financial and business

interests of the concern. If he has any orders or directions to give, with reference to the work, they should be given to his superintendent, that he may have order and system in his department. Where ignorance of business and lack of system prevail, there are always discord and extravagance. If only a shed is to be erected, or the establishment, when completed, employs only half a dozen hands, let a system be adopted at once to be improved as necessities may require.

The Allen Valve Gear.

BY HUGO BILGRAM, M. E.

With the Allen valve gear the functions of admission and exhaust in an engine are entirely separated, and assigned to two distinct sets of valves. Both sets of valves are moved by a link motion which is substantially like that of Pius Fink, with the distinction that the exhaust valve is worked from a fixed point of the link, and only the admission valve from the adjustable sliding block, while in the Fink link motion a common steam and exhaust valve obtains its motion from the sliding block, whereby the exhaust as well as the admission is affected by an adjustment or shifting of the link block. The link and eccentric strap are in one piece (see Fig. 7), which is represented in Fig. 8 by the center lines *b B D I*. The link is hinged at the point *D*, by means of the arm *D G*, to the frame of the engine, *G* being the fixed point. From the highest point *b*, of the link is derived the motion for the exhaust valve, by means of the connecting rod *b p*, the rocker *p f p'*, and the valve stem *p' v*.

The admission valve receives its motion from the link block *B*, by means of the radius rod *B P*, the rocker *P F P'* and the valve stem *P' V*. A variation of the rate of expansion is effected by raising or lowering the block *B*, and radius rod *B P*, by means of a Porter governor, the range of this motion being from *β* to *D*. The line *O P* is the center line of action of the eccentric and link, and the eccentric is set upon the shaft to be in its line of action when the crank is on its center.

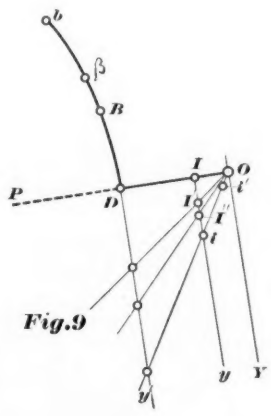


Fig. 9

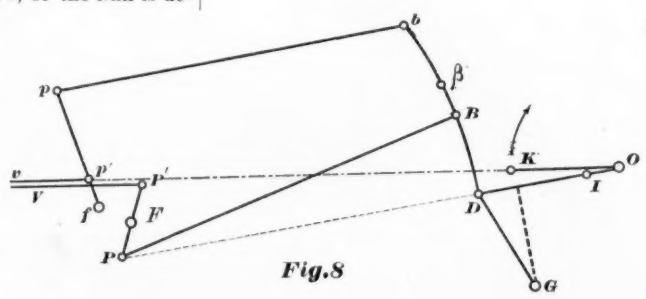


Fig. 8

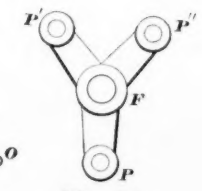


Fig. 13

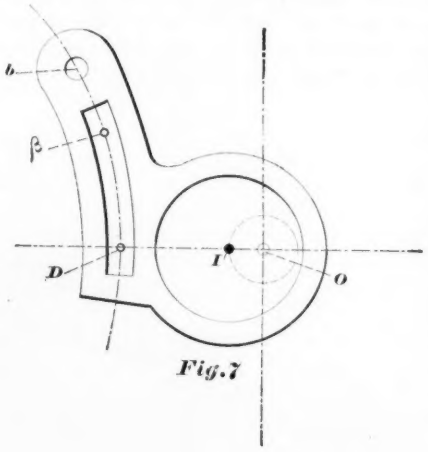


Fig. 7

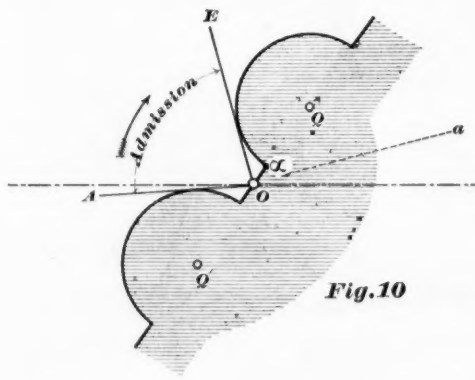


Fig. 10

Fig. 11

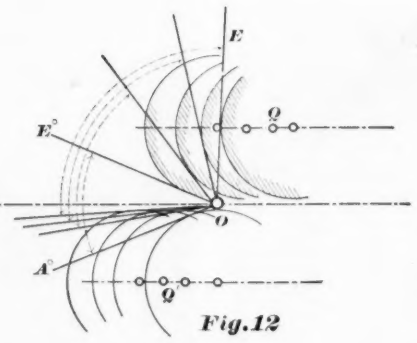


Fig. 12

When the shaft *O* is rotating, the link obtains a very peculiar movement by the eccentric moving the point *I* in a circular path, while the point *D* is confined in its movement to a short arc of comparatively long radius. It is as it were a combination of an oscillating and a reciprocating movement, and at first sight it appears very difficult to analyze the movements obtained from the points *b* and *B*. It is, however, fortunately, not difficult to show that the movement of either of those points is practically equivalent to a motion produced by eccentrics, and the location, in relation to the crank, of the ideal eccentrics which are capable of producing an equivalent motion may be found as follows: Imagine the link *b B D O*, in Fig. 9, drawn in such a position that the eccentric strap is concentrical with the center of the main shaft, and the center *I* of the eccentric in its line of action (see *O P*, Fig. 8), draw from *I* and from *D* the lines *I y* and *D y'* at right angles to the line *O P*, mark on the line *D y'* points corresponding by their vertical distance from *D* with the points *B* and *b*, and draw radial lines from these points to *O*. The required ideal eccentrics are located where those lines intersect the line *I y* (see *I'* and *i*.)

As the block *B* is raised or lowered in the link slot, the corresponding ideal eccentric changes its position on the line *I y*, the limits for that change being *I* and *I''*.

The angle of advance of the movement of the admission valve is *Y O I'* (Fig. 9), that of the exhaust valve *Y O i*. The travel of the block *B* is equal to twice the distance *O I'*, that of the point *b* equal to twice the distance *O i*. But owing to the leverage of the rock-arms, the travel of the exhaust valve is reduced to about one-third of that of the pin *b*. It may, therefore, be assumed that the steam valve is moved by the eccentric *I'* and the exhaust valve by the eccentric *i'*. The valve diagrams can then be drawn as shown in Fig. 10 for admission, and in Fig. 11 for exhaust. There being no lap on the exhaust valve, the exhaust lap circles are infinitely small, and are represented in Fig. 11 by the points *q* and *q'*.

The next question is: What will happen if the link block is lowered or raised? Only the admission valve will be affected, as the ideal eccentric for its movement is shifted on the line *I y*, Fig. 9. The corresponding centers of lap circles of the diagram will move on the horizontal line passing through *Q* and *Q'*, (see Fig. 12) and by sweeping several sets of lap circles (the extreme ones are included in the drawing) it will at once be seen that the cutting off can range between a very early point (*O E°*), and a point slightly beyond half stroke (*O E*).

The linear lead of the valve is indicated in the diagram by the distance of the lap circles from the horizontal center line, which is shown to be uniform for all grades of cutting off. The crank angle at which admission begins is, however, variable, and care must be taken in designing the valve gear lest the earliest admission, at *O A°*, takes place before the exhaust valve closes at *O C* (Fig. 11).

Another peculiarity will be noticed, *i. e.*, that the greatest port opening (the distance of the center *O* from the nearest point of the respective lap circle) is comparatively small, especially when the cut-off ranges early. This defect is, however, compensated for by a peculiar construction of the valves, which permits admission through four openings simultaneously, as in a gridiron valve. The diagram shows further that, notwithstanding the small total opening, the total travel of the valve is comparatively great, the proportion between opening and travel being as *O a* to *Q Q'* (Fig. 10).

The present users of this valve motion have therefore adopted an expedient to reduce the travel of the valve during the period of closure. Instead of using the rocker *P F P'*, as shown in Fig. 8, a forked rocker, shown in Fig. 13, is adopted; the steam valves for both ends of the cylinder are made independent of one another, and moved separately by the pins *P'* and *P''*. By this arrangement the movement of the upper arm of the rocker is more nearly vertical during the period of closure, and only the horizontal component of the movement is transmitted to the valve. In this case the diagram can properly be applied only to the movement of the lower arm of the rocker, and the movements of the valves must be deduced therefrom. Even the laps of the valves should be measured by the movement the point *P* (Fig. 13) is required to make, starting from its neutral position, until the valves begin to open their respective ports. The general character of the valve gear, as indicated by Fig. 12, is, however, not affected by this variation.

There are numerous causes inducing slight irregularities into the movement; for instance, the slightly curved instead of strictly rectilinear movement of the pin *D*; the angularity of the line of centers, *I D*, of the link and eccentric strap; the oscillation of the link, and many others. All these causes combine to produce a result which, more or less, differs from the indications of the diagram, but by a careful selection of certain dimensions these irregularities can be made to nearly compensate each other. The method employed for finding these proportions is very intricate, and is of interest only to the manufacturers; while the general theory, as above demonstrated, is equally interesting to the purchaser and to the engineer having charge of such engines.

From *Engineering*, we learn that in the Board of Trade investigation of the railroad collision at Blackburn, some months since, persistent effort was made to throw the blame of the accident on the Westinghouse brake. It was shown, however, that the engineer had but little experience in the use of the brake, that he had mismanaged it on a previous occasion, and appeared to know little or nothing of its functions. The evidence of the passengers who testified was unanimous with reference to the improper manner in which the engineer handled his train on the trip, previous to the accident; also that the brake did go on at Blackburn, notwithstanding his testimony to the contrary.

Chaplets and Their Use.

BY THOMAS D. WEST.

In making castings that require the use of chaplets, the moulder is frequently annoyed by complaints about blow holes. If asked what caused the blow holes, he would be likely to say that the chaplets must have been rusty, of which there can be no question. To know what this rust is, and its chemical action when surrounded with hot iron, should be of as much interest to engineers and machinists as it is to the moulder. Any one employed in a foundry knows—some to their sorrow—that to take a rusty rod and quickly push it into a ladle of melted iron will cause the iron to fly in all directions. This is caused more from the dampness than from anything else; as all rusty iron is more or less damp, and hence, when plunged in the hot iron steam is instantly generated, which scatters the iron in its efforts to escape.

To demonstrate this, take a rusty rod, heat it enough to dry up all the moisture, and then put it into a ladle of iron. The iron will boil around it more or less, but will not fly over the foundry as it would if the rod was not dry.

There are two things to be contended against in the effort to keep melted iron from blowing or boiling when enclosing rusty iron. The first is steam, and the second is carbonic oxide gas. This gas is formed by the carbon in the hot iron combining with oxygen.

Take a piece of polished iron and let it get damp from the moisture of the air—or otherwise dampen it—and it soon becomes rusty, because of the affinity of iron for oxygen when combined with water. Under certain conditions, polished iron can be kept from collecting rust or oxygen; as by keeping it no colder than the temperature of the air, and keeping the air dry. Take the iron from a cold room into a warm one, and it will not be long before rust will collect on it. This is caused by the cold iron condensing whatever moisture there may be in the air.

To determine how much gas is formed in a mould when melted iron comes in contact with rusty iron, I cut off a piece of ½" round iron one foot long, and had it weighed on a pair of fine scales. I then took the rod and heated it red hot so as to burn off all the rust, after which the rod was reweighed and found to weigh 60 grains less.

To know how much gas this 60 grains of rust or oxide would form, I submitted the matter to a chemist, Mr. L. H. Witte, who found that 60 grains of rust in melted iron would make 31 grains of carbonic oxide gas, which at 2800 degrees of heat (the melting point of iron), and a pressure of one atmosphere, would occupy about 600 cubic inches of space. The volume, or space, which gas occupies depends on the pressure. If a moulder sets rusty chaplets, the damage will be proportioned to the temperature and pressure of the iron around them. It is very seldom that chaplets in common pipe and similar castings have blow holes around them on the side cast down. It is on the top or cope part, where there is very little pressure that the blow holes are found. The same may be said of cylinders, or other castings where chaplets are used.

The question might be asked: Why is it that where the greatest pressure is, the gas escapes the easiest, and without causing blow

holes? The parts of a mould where the greatest pressure is, are usually the first to be filled, and the iron is hotter and cleaner than at the top of the mould. Should the chaplets at the bottom cause the iron to blow or boil, the gas will escape upward through the iron, and come out of the mould at the runners or feeders. The iron being hot, the pressure will not allow any holes or cavities to exist, but should the iron boil or blow around chaplets in the upper sections of a mould, it will generally leave blow holes in the casting, because of the iron being dull, or having no life in it, so that the gas cannot escape through it, but stays around the chaplets. The size of the cavities will depend on the amount of gas formed, that cannot escape.

Chaplets are very often kept in moulds for two or three days before the mould is cast. In such cases they are very apt to corrode or get rusty, especially if the mould is a green sand one.

The moulder may paint or varnish the chaplets, to protect the iron from getting rusty, but the paint or varnish will sometimes create more gas than the rust or oxide would. Again the paint may be of such a nature as to protect the iron chaplet from rusting, but hold moisture itself, and when the melted iron surrounds the wet chaplet it forms a cushion of steam around it and the blow holes are formed, the same as from the gas caused from the rust.

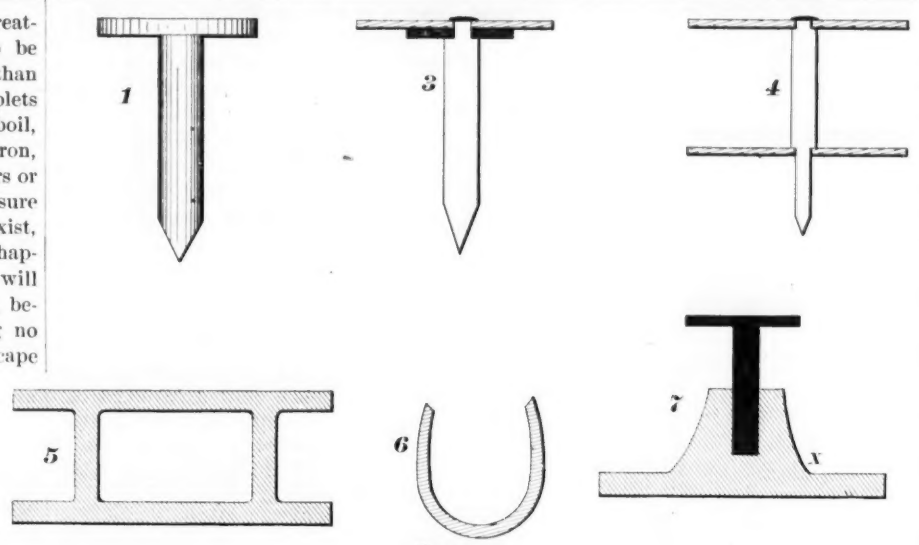
About the best thing to prevent chaplets from blowing, or boiling the iron around them, is to have all the rust burnt off and have them tinned over, which can be done to advantage for a standard class of work. The affinity of tin for iron makes the iron hotter. Pieces of tin are often thrown into ladles of iron to make the iron softer and more fluid. The tin, beside making the iron around the chaplets hotter, so as to give any gas that may be formed a better chance to escape, also protects them from collecting moisture and getting rusty.

For castings where it is essential that the upper section shall be sound, it is best to use what is called a loam chaplet. This is made by taking solid iron, wrought or cast, and daubing the surface exposed to the melted iron with a thin coat of loam. This will leave a clean hole in the casting which the machinist will have to tap and plug up, but when the casting is put to the test, there will be no danger of blow holes around the chaplets. In using such chaplets pieces of iron can be built up on top of the core arbors so as to come even with the face of the core, and have the chaplets rest on iron instead of on sand. By this method fewer chaplets will be required to hold down a core. The fewer the chaplets used the better and stronger the casting.

Red lead mixed with turpentine is one of the best paints for chaplets. Chalk, coal tar, oil and asphaltum, etc., which are often used on chaplets are not reliable. In some shops cast and wrought chaplets are used very extensively. The cast iron ones are the best to use on castings that require to be finished, as the melted iron adheres to them better than to wrought iron ones. In some cases where castings are finished, the chaplets cannot be seen.

Cast iron chaplets can be made of any shape or size, and used in castings from ¼″ up to 4″ thick, but care must be taken not to set them where the gates will cause the iron to run against them as they melt very readily.

The cuts, Nos. 1, 3, 4, 5, 6 and 7, show a class of wrought and cast iron chaplets that are very handy for most classes of work. No. 1 is a cast iron chaplet that can be made very readily from ⅜″ to 1″ diameter and of any length required. They are made by ramming up a deep flask having a level joint, and after the cope is off, bedding in the heads and driving down the long stem any length wanted. They should be notched with a chisel on each side before knocking them off, as they are apt to break below the surface of the casting when roughly knocked off.



CHAPLETS.

No. 5 is a double headed chaplet, used particularly on loam and dry sand work. A pattern will be required for each size wanted.

No. 7 shows a cast iron chaplet and stand which is very handy for loam, dry or green sand moulds. The face of the stand *X* is set against the pattern and rammed up, or built up in the brick work. The only objection to using this stand is, that it will chill the casting, for which reason the stand should not be set on any part of a casting that requires to be finished. These stands are better if cast solid and the holes for holding the chaplet drilled out. When setting the chaplets, if they are too long, break off a piece, and if too short, fill up the holes with sand. Iron flasks for special jobs often have holes drilled in the bars to hold chaplets, whereby much time and labor is saved.

No. 3 is a wrought iron chaplet, having a large double head riveted to the stem. This is safer than having only a single head riveted on, especially for large cores that have a heavy lift under them.

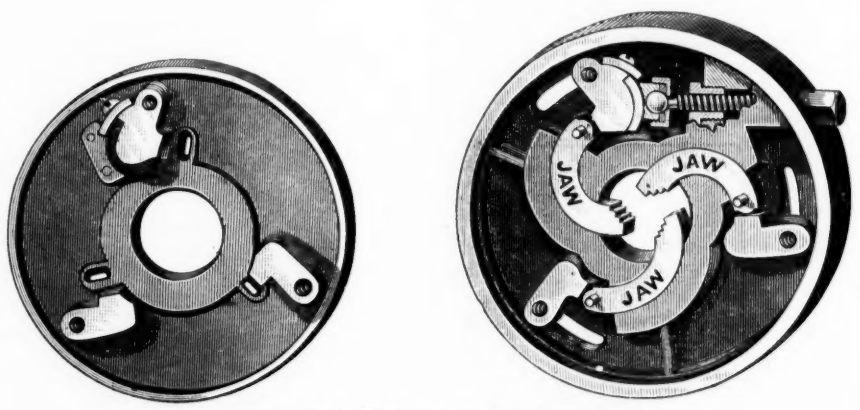
Some blacksmiths can take a nut, and by putting a shoulder on the round stem, weld the nut on, making a head on a chaplet 3 or 4 inches broad, which is safer than a head riveted on over a small shoulder.

Chaplets that do not require very large heads can be made cheaply in a machine for heading bolts.

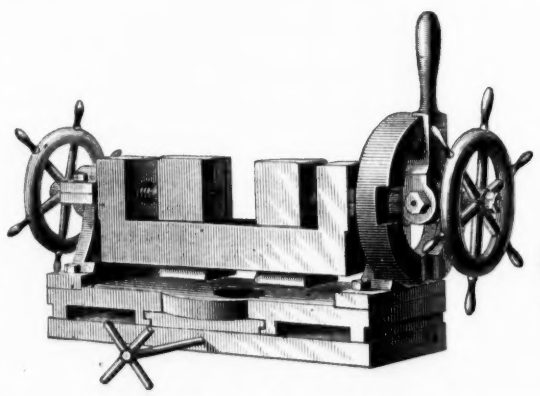
No. 4 is a double-headed wrought iron chaplet, having a sharp stem, to be used on loam and dry sand work. The top head is riveted on and the lower one is made to slide up on the stem to a shoulder, which is filed to make the chaplet the size wanted.

No. 6 is a spring chaplet made from hoop, sheet or plate iron, bent with the grain of the iron. This is very handy for placing between cores where it would be hard to make a stiff chaplet stay.

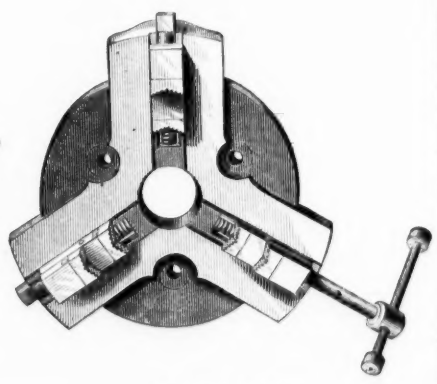
As regards the size of iron for making chaplets, the moulder must use his own judgment, as different castings require chaplets of various sizes and strength. Chaplets are a very important feature in the manufacture of castings, and are always an eye-sore to look on, as they disfigure castings more or less. A good moulder will use as few of them as possible.



THREE-JAWED CONCENTRIC GRIPPING CHUCK.



TAPPING MACHINE CRANK CHUCK.



FLANGE CHUCK.

New Tools for Pipe and Fittings.

The three-jawed concentric gripping chuck, which is represented by two of the accompanying engravings, is intended for holding wrought iron pipe for cutting threads upon the end. The front plate, with three dogs attached, is shown in one engraving, while in the sectional view these dogs, which form a part of the plate, are represented in their respective positions, with the thin part of the plate only, removed to show the internal construction of the chuck. The jaws are made of steel of the peculiar shape shown, and are operated by a steel screw having a ball and socket joint at its end. By exerting a pressure against the dog with the screw, the plate with the three dogs attached is moved forward, which closes the jaws upon the pipe. The nut at the end of the screw is held to the jaw by a curved plate, as shown.

By turning the screw in the opposite direction the plate is also moved, while the pins in the jaws, filling the curved slots in the plate, compel them to open, thus releasing the pipe.

Three bolts passing through the back, hold the plate. These bolts move in slots and are tightened against shoulders, so as to allow a free movement of the plate. This chuck is held to the face plate of the machine by tap bolts in the usual way.

This chuck will take all sizes of pipe from ¼″ to 2″.

By having three jaws connected together, as shown, the pipe is centered better than where only two jaws are used and operated by a right and left hand screw. The two jaws when worn at the sides cause the pipe to run very much out of truth. The flange chuck also shown in an accompanying engraving has three independent jaws, and may be applied either to the face plate of a machine or drill press. It is for holding pipe flanges from 3″ to 12″ in diameter, while the hole is being tapped. After one flange has been properly set, other flanges of equal sizes may be placed therein by simply operating one jaw.

The tapping machine crank chuck, as shown herewith, is for application either to a drill press or tapping machine. It has two jaws operated by separate screws. The dies are made of cast iron in any special form for holding elbows, tees and other different kinds of fittings. It has a compound movement at right angles to each other, so that when the tap enters the hole it will draw the fitting into line with the spindle. The screws for operating the dies pass through the journals at each end. The chuck may be turned around by a handle. The circle is divided into four equal parts, designated by notches.

The three holes in the tee can be tapped in this chuck without resetting, all the trouble necessary being to move the handle from one notch to the next which will bring the holes in the fitting exactly at right angles to each other. This chuck is made in four sizes, for holding all fittings from ¼ inch up to 8″. These tools are made by D. Saunders Sons, Yonkers, N. Y.

Scientific Mining.

"No; no hoisting works—not if I know it. You can fool away a good deal of good, hard coin on hoisting works." "How then do you run your mine?" "On the assessment plan, sir. That's the latest and most approved method. When we have a good map of the lower workings we don't need any works to speak of. I keep a man in Virginia at $60 a month to superintend the location and write weekly letters, and I stay in San Francisco in my office on Pine street, and levy the assessments every sixty days; that's as often as the law allows. I am the president, board of trustees, secretary, treasurer, and everything—more especially the treasurer. Of course I draw salary for all the offices, and when I get through drawing salaries I turn the rest over to the agent in Virginia to pay off the hands. By not employing any hands, he saves enough to pay himself. This is what I call scientific mining, sir. You get the silver out of the pockets of the stockholders and leave the vast argentiferous and auriferous deposits in your claim for your children, who can go right ahead and develop the mine just as soon as the public quit putting up, which isn't at all likely to happen. As long as people are being born in Nevada and California my mine will run on like a chronometer clock." "But," said the Utah man, "my style of mining keeps lots of men at work." "So does mine," quoth the Golden Gate chap. "Thousands of men are working night and day to pay the assessments. It keeps the country as busy as a bee-hive," and the speaker sauntered to the telegraph office to order assessment No. 36.—*Denver News.*

It is stated by persons who have investigated the subject that the result of copper mining in Maine thus far has been a product of 17,000 pounds, at an expense of $500 per pound.

The Allen Slide Valve.

In consequence of numerous requests for information concerning the Allen Slide Valve we publish herewith an engraving and description of that valve, which, although extensively used in Europe for a number of years past, has been applied only to a limited extent in this country. Referring to the engraving the reader will see that the valve *A* is, in general appearance, like the common D slide valve, but with this difference:

It has a supplementary steam port *D*, cored out between the exhaust cavity and the outside shell. The object of this construction is to obtain a high initial pressure of steam in the cylinder at the commencement of the stroke, and a reduced travel of the valve, which is done by means of the port *D*.

The valve and seat are so proportioned to each other that when the steam port in the cylinder begins to open past the edge of the valve, the edge of the port *D* also opens past the edge of the valve seat.

Thus a port of double the area of that given by the ordinary slide valve is obtained. This is a very important feature upon locomotives running at high speeds, as in cutting off short the opening of the ports is greatly reduced; as for instance: Some locomotives in cutting off at 6″ have a port opening of but $\frac{7}{16}$″ which causes the steam to be wire drawn in entering the cylinder. With the Allen valve a shorter cut off may be used, with a much greater degree of expansion and economy than with a common D valve. One of the principal things to be observed in designing the Allen valve is, to lay out the valve and seat so that steam may not blow through the supplementary port into the exhaust when the valve is at its extreme travel.

If the reader will lay out a valve and seat, upon two pieces of cardboard or wood, and slide one over the other he will readily understand what is meant, and will form better ideas of the advantages of a large port opening at the commencement of the stroke.

As the valve continues its travel, the supplementary port closes, but by that time the cylinder will be receiving all the steam that is necessary, and as stated, its true advantage is in cutting off short.

In order that the best results may be secured, this valve should, upon a locomotive having 24″ stroke, be set to cut off at 14″ to 15″ when the lever is placed at full gear.

Many of the trials of the Allen valve in this country, have been conducted in a very inconsiderate manner, in giving it the same travel as the ordinary D valve, and in not laying out the ports properly. The Allen valve is necessarily heavier than the common valve, and the increased size of ports also means an increase of friction. It is, therefore, obvious that it should be balanced by the application of one of the many balancing devices in existence for that purpose. One of the most simple of these devices that we have ever seen, was illustrated and described in the AMERICAN MACHINIST of July 16, 1881.

It consists of four independent parallel strips of cast iron, *F F*, *G G*, placed in grooves around the top of the valve. The steam passes under these strips and raises them up against a plate *C*, bolted to the steam chest cover *B*. The space enclosed by the strips is open to the exhaust, by means of the aperture *E* in the top of the valve, and allows any steam which might leak through the joints to escape.

The patent on the Allen valve has expired, as we have heretofore stated, but that on the balancing device is still valid.

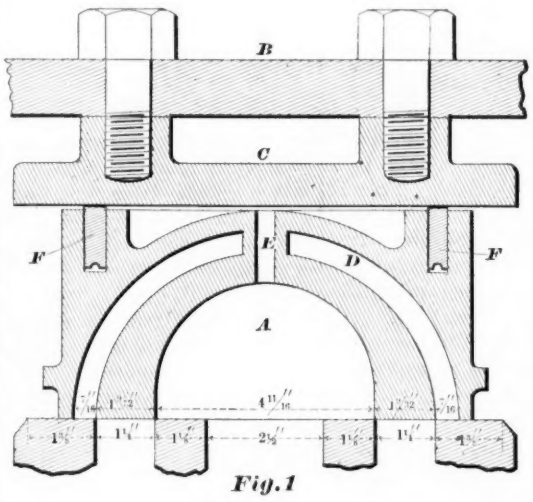


Fig. 1

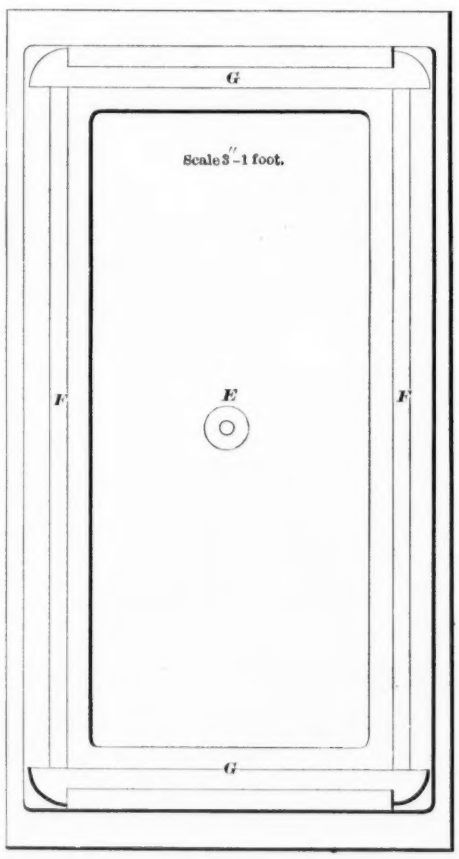


Fig. 2

THE ALLEN SLIDE VALVE.

We learn from English papers that the electrical exhibition in the Crystal Palace at Sydenham is in a backward condition, and that it is not probable it will ever assume such proportions as the recent Paris exposition. Objections are taken by exhibitors to the space alloted them, or rather to being sandwiched between dry goods, refreshment bars, etc. This disposition of the exhibitors, which is unavoidable, has the effect of scattering the exhibits in such a way as to detract from the general effect. Taken as a display of electric lighting it will be magnificent.

Management of Workmen.

By S. W. GOODYEAR.

How can it be possible to lay down any rigid rules by which the proprietor, superintendent or foreman shall be governed in his treatment and management of either journeymen or apprentices? With the fact before us that men differ so much in their capacity to learn, and in their temperaments and dispositions, coupled with the influence which family relations, or social surroundings may have upon men, often transforming the naturally careless man into one of the most painstaking of workmen, or on the other hand changing the best of workmen to the worst of "slouches," is it not rather the fact that the secret of successful management lies not in the direction of that impartial treatment which is so often recommended, but in closely observing the differences in men, and treating them accordingly? It seems to be the opinion of some that the reason why certain foremen get so large a proportion of bad work from the men of whom they have charge, is because they do not often enough accord full praise for the good work which is done. Upon inspecting the job which the apprentice or journeyman has thought to be good enough, some foremen invariably have fault to find, or if not actually finding fault, they accept the work saying: "It will have to go I suppose." It may be very unpleasant to the really good workman, who knows what good work is, and takes pride in doing it, to work for a man who never appears to appreciate his endeavors. If, however, he is a true mechanic, this will not deter him from doing good work. His self-respect and actual love of nice mechanical operations will keep him in the right track. Neither praise nor flattery are needed to get good work from such a man. On the other hand it is a fact that there are many mechanics who never do a job quite as well as it might or should be done, and to praise, or accept whose work as passable even, without cautioning them to do better next time, would be to them not an incentive to do better work in the future, but an encouragement to follow their natural inclination to see how poor a job they can make pass. There are men who must be handled as carefully as you would handle eggs, men with much spirit, extremely sensitive, on the watch continually for fear they will be either ill-treated or slighted. These are, nevertheless, in some cases, the best of workmen.

There are men who can be changed from one kind of work to another twenty times a day, ready to break off smilingly in the midst of a job, never annoyed, and always doing good work. Such a man is a prize, but no more so than the man who will scowl, and even growl or quit if you insist upon changing him about from one job to another. The latter individual is so constituted that when he commences a job he fully charges his mind with all the details from beginning to end, and to take him off until it is completed, disturbs him beyond his power of endurance. There are men who need driving up to get a fair day's work from them, and others who need holding back to prevent their work being slighted in their endeavors to do too much. Men and boys there are who have bright cheerful homes, whose lives outside the shop are kept pure through the influence of right-minded fathers and mothers, brothers and sisters, or wives and children; while others—away from relatives and friends, make a boarding house simply a place in which to eat and sleep, not a home, their leisure hours spent in amusements, or indulgences.

Many of the hours which should be devoted to sleep even, are spent by them in a manner which impairs both mental and physical abilities. There are those who are quick to comprehend, either by drawings or instructions, all the requirements of a job of work, and still others, who at a glance think they see the whole, and to any explanation are ready to say, "yes," "of course," "that's plain enough," yet still go on and make a "mess" of the whole job. Ultimately it is found that these individuals not only knew nothing about what they said so glibly, "yes, I understand," but that they have not the capacity to learn. Next come those of apparently dull comprehension, of whom there are some who can tell you truly they "don't see through it," and others who, not quick to see, will, if time be given them to investigate, never stop short of the most thorough understanding of the minutest details. Again, there are men who are so awkward as to be kept for months or years from attempting even to do anything requiring skill and dexterity, but who, becoming piqued at the implied lack of confidence in their ability, determine to not only do, but to *excel in doing*, at the first opportunity, that which had been supposed to be impossible for them to learn to do even tolerably, and who succeed in their resolution. There are men of great natural ability as inventors, to snub whom, and to ignore whose many suggestions is, to render them almost useless in the shop. On the other hand, there exists a class who continually suggest improvements in machinery and processes, whose plans it will never do to adopt. If those who talk so glibly about how to manage help, and how easy it is to always turn out good work, often saying that "it is just as easy and takes no longer to do work just right," would consider that the superintendent or foreman who gets the blame when bad work passes through his hands is many times obliged to get along with men who, not only do not understand, but have not the ability to learn what is right, they would change their minds about the easy duties of those who have charge of help.

Fire Inspection in Manufacturing Establishments.

In every manufacturing establishment, a reliable system of fire inspection is of the greatest importance. In the works of the Yale Lock Manufacturing Co., Stamford, Conn., an intelligent and careful workman (who devotes the greater part of his time to regular shop employment) is selected to act as fire inspector, making regular and systematic visits of inspection over the whole premises and noting his observations on a blank prepared for the purpose. We append a copy of the blank used (reduced in size), together with a recent report in full, exactly as made by the fire inspector, to give an idea of its sensible and practical character,

INSTRUCTIONS FOR
INSPECTION OF FIRE APPARATUS.
YALE LOCK MANUFACTURING COMPANY,
STAMFORD, CONN.

Each inspection is to cover the entire premises of the Company.

1. The inspector will examine every hose connection, move every hose valve or cock and see that the hose is properly connected and readily accessible for use. Also see that every fire bucket is filled with water, and that each fire lantern is filled, trimmed and ready for use.

2. The inspector will carefully examine the surroundings of every steam boiler, stove and heater to see that no inflammable materials are near them, that all smoke and flue connections are tight, stove pipes well secured, and everything safe.

3. The inspector will carefully follow the line of every steam pipe, throughout its whole length, to see that it is not in contact with wood, and that no waste or other inflammable materials are near it. In summer this need apply only to such pipes as are then in use. In winter *all* steam pipes must be inspected. Any leaks in pipes or valves are to be immediately reported to the Superintendent.

4. The inspector will carefully examine spaces beneath all work benches and tables, and will remove therefrom any inflammable materials he may find. All cases of carelessness which he may note in this inspection to be promptly reported.

5. The inspector will particularly examine all places where oils, varnish, alcohol, lacquer, japan, etc., are stored, to see that every precaution is taken against fire. He will also inspect every receptacle for dirty waste, to see that it is in proper order and place.

6. The inspector will note the condition of the yards, and see that no accumulation of inflammable materials occurs near any of the buildings.

7. Once monthly the inspector will carefully examine every chimney used for fires to see that its joints are tight, particularly near the roof or other woodwork, and that no inflammable dirt is collected near it.

8. Once each month the inspector will take down and uncoil every fire hose, leaving it extended over night and replacing it properly the next day. In doing this he will note the condition of the hose and see particularly that it is not becoming cracked or injured by the method of hanging or otherwise. All defects in hose to be promptly reported to the Superintendent.

REPORT.

To the Superintendent:

I have to report that on *January* 14, 1882, I made a thorough inspection, in accordance with the above instructions.

I found the instructions numbered 1, 2, 4, 5, 6, to have been properly complied with, and everything in the place and condition designated.

I found violations of the instructions numbered 3.

I report the following matters as needing attention, viz:

The hose valve in the north west corner of pulley block shop needs repairing. There is a hose rack needed in the old foundry to hang the hose on. My intention was to have the fire buckets in the box shop placed near the heater, for in their present position they will freeze.

I make the following suggestions for the better protection of the property, viz:

I will report the new building as not being

kept cleaned of shavings, paper, straw, etc. It is my opinion that there ought to be fire buckets placed in different parts of the new building and the hose placed in the building as soon as possible, for I think those plumbers are not careful enough with the furnaces.

HENRY SMITH,
Inspector.

On some Italian railroads the cars, which are of the American type, are warmed by hot water contained in metallic cylinders. These cylinders are of a portable size, and as they get cold are changed at the stations for fresh ones. The heat is said to be particularly agreeable.

German engravers harden their tools by heating, and then cooling by repeatedly plunging them into and withdrawing them from sealing wax until they are cold. This makes them very hard, and the temper is said to be excellent.

Cone Pulley Diameters.

BY C. A. SMITH (VOTRE AMI.)

John Coffin's defence of Professor Sweet's graphical method of determining cone pulley diameters, in the AMERICAN MACHINIST of January 7, has been duly noticed.

My "error" was in not being sufficiently specific in my statements. Although strictly correct in regard to Professor Sweet's first method (Vol. IV., No. 35), my statement would have been more nearly correct in regard to his second method (Vol. IV., No. 38), if I had modified it to the effect that generally it is neither reliable for crossed belts nor yet for open belts. For small belt angles and long distances between centers, it is close enough for practice, as I stated, but for the special case for which it was given—large belt angles and small distances between centers—it varies too much to be reliable, which I think I will be able to show.

Mr. Coffin says that by taking an example in which the belt angle ranges from 30° to nothing, he can obtain no greater error than $\frac{1}{245}$ of the distance between centers. This will depend altogether upon the distance between centers, and upon the diameters of the pulleys, as will appear hereafter.

Taking an example with 32 inches between centers, and calculating the diameters and lengths of belts on every change, according to the method he refers to, we obtain, Table I,

TABLE I.

No. of Changes.	Diam. of Small Cone.	Diam. of Large Cone.	Difference of Diam.	Belt Angle.	Length of Belt.
1	4.78	36.78	32.	30°	137.42
2	7.58	35.58	28.	26°	138.02
3	10.25	34.25	24.	22°	138.46
4	12.79	32.79	20.	18½°	138.73
5	15.24	31.24	16.	14½°	138.94
6	17.57	29.57	12.	10⅝°	139.19
7	19.81	27.81	8.	7⅛°	139 30
8	21.95	25.95	4.	3½°	139.39
9	24.	24.	0.	0°	133.40

which represents a pair of cones with nine changes. Here we find a maximum difference of very nearly two inches in the length of belt between the limits of 0° and 30° of belt angle. In another case with 100 inches between centers, I obtained over *eight inches* difference in the lengths of belt. This is evidently a much greater discrepancy than Mr. Coffin represents. Of course, a pair of cones with this range of angles would seldom be used; but suppose we want a pair of cones with the first three changes, we then still have a difference of nearly one inch in the lengths of belt, which would be quite sufficient to make an annoying difference in the tension of such a short belt.

As to the simplicity and convenience of the method, I agree with Mr. Coffin. Now, since it is convenient, can we not modify the construction, without materially complicating it, so as to make it more accurate in *all cases?* This, I think, we can accomplish by the following method:

Referring to Fig. 1, lay off the center line *A B*. The first pair of pulleys can always be assumed or determined by the conditions of the machine. Draw these to the size assumed, as at 1 *A*, 1 *B*, and draw the belt line *E F*. Now locate the point *C*, by measuring off the distance *A C*, from the center of the *small pulley*, equal to 0.496 times the distance between the centers (*A B*). From this point draw the line *C D* perpendicular to *A B*, and make *C D* equal to the line of centers divided by 3.1416; that is,

$$A\ C = 0.496 \times A\ B \text{ and}$$
$$C\ D = A\ B \div 3.1416.$$

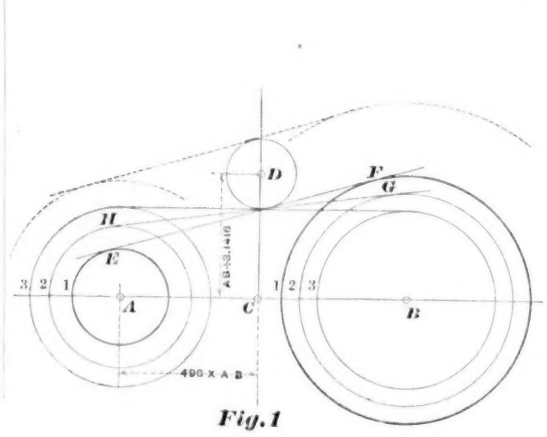


Fig. 1

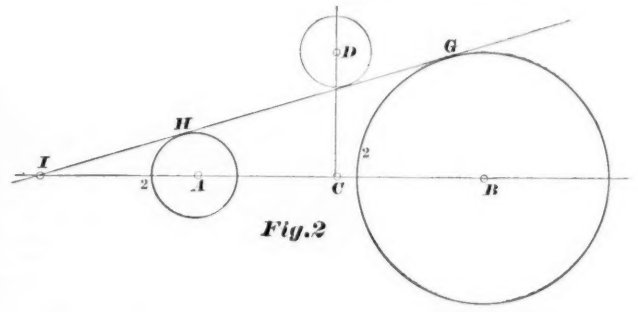


Fig. 2

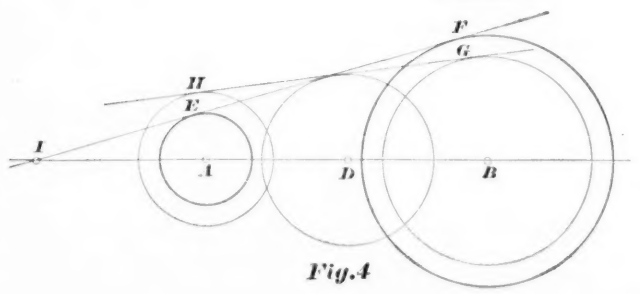


Fig. 4

With the point *D* as a center describe the circle at *D*, tangent to the belt line *E F*. Now any other pulley, as 2 *A* may be drawn in. Then draw the line *H G* tangent to the pulley 2 *A*, and tangent to the directrix circle *D*. This will be the belt line for this pulley, and the counter pulley, 2 *B*, can be drawn tangent to it, and its diameter measured. In the same manner any number of pulleys may be obtained, as 3 *A*, 3 *B*, etc., the belt lines always being tangent to the directrix circle *D*.

In some cases the belt line *E F* may pass above the center *D*. In that case all the belt lines will be tangent to the directrix circle on the opposite side, as shown by the dotted lines, and the solution will be equally accurate.

Now, if the line of centers is quite short, so as to bring the point *C* very near midway between the centers, and the diameters of the first pair of pulleys are such as to bring the belt line *EF* to the center *D*, then this method will be identical with the one Mr. Coffin refers to, and in that case the latter will be equally accurate.

This method, as represented in Fig. 1, is not mathematically correct, but the approximations are remarkably close, and equally so for all possible cases between the limits of 30° and 0° of belt angle, whether the line of centers be short or long.

Now, let us see how this compares with the other method. Taking the same example as before, and basing our calculations upon the construction represented in Fig. 1, we obtain table II:

TABLE II.

No. of Changes.	Diam. of Small Cone.	Diam. of Large Cone.	Difference of Diam.	Belt Angle.	Length of Belt.
1	5.40	37.40	32.	30°	139.36
2	8.05	36.05	28.	26°	139.52
3	10.61	34.61	24.	22°	139.55
4	13.06	33.06	20.	18½°	139.58
5	15.41	31.41	16.	14½°	139.57
6	17.69	29.69	12.	10⅝°	139.54
7	19.87	27.87	8.	7⅛°	139.49
8	21.98	25.98	4.	3½°	139.44
9	24.	24.	0.	0°	139.40

By comparing this with table I., we see that there is a maximum difference of nearly two inches in the length of belt in the latter, while there is but 0.22 of an inch difference in the former table. Also the first pair of pulleys in table I. are *five-eighths* of an inch too small.

An example, with 100 inches between centers, and the same limits of belt angle, gave a maximum difference in length of belt of only 0.14 of an inch in a belt length of 388 inches, as against eight inches of the other method in a belt length of 451 inches.

To lay off the pulleys, so as to get any desired velocity ratio of the shafts, we may proceed as follows: After having laid out the first pair of pulleys and determined the directrix circle *D*, as explained in connection with Fig. 1, divide the center line *AB*, Fig. 2, into as many equal parts as the shaft *A* is to revolve, less one, while the shaft *B* makes one revolution. From *A* to *I* lay off one of these parts. Thus: if the shaft *A* is to make four revolutions while *B* makes one, then lay off $AI = AB \div 3$. If *A* should revolve five times to one revolution of *B*, then $AI = AB \div 4$, etc. Having located the point *I*, lay a straight edge to it, and tangent to the circle *D*, and draw the line *IHG*. Now draw, tangent to the line *IHG*, the two circles 2*A* and 2*B*, which will be the pair of pulleys required. By laying off another point *I* for a new velocity ratio, another pair of pulleys may be determined, as before, and so on indefinitely.

Of course the accuracy of the result depends largely upon the accuracy of the drawing. It will, therefore, always be desirable to lay it out on as large a scale as possible.

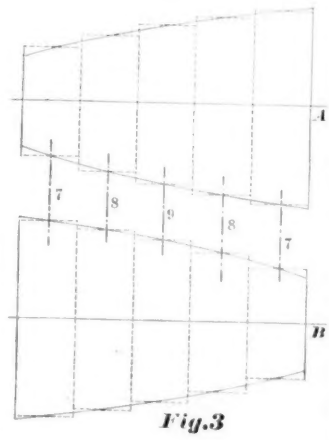


Fig. 3

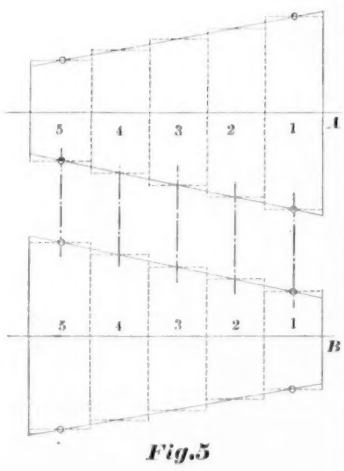


Fig. 5

Fig. 3 represents part of the cones represented in the tables, the full lines representing continuous cones and the dotted lines stepped cones. When two equal cones are wanted, only half the number of diameters need be determined, since those on one side of the equal pulleys are simply repeated on the other side.

As a matter of geometrical interest, it may be noticed that for crossed belts, the center of the directrix circle is located upon the line of centers, midway between the centers *A* and *B*, Figure 4. Otherwise the process of laying out is exactly the same as in Figures 1 and 2. Similar points are marked with the same letter in all figures, so the general explanation will be applicable to all.

Of course, Figure 4 is of no practical value, since there are better and simpler ways of determining cone pulley diameters for crossed belts. Thus: In Figure 5, the extreme diameters 1*A*, 5*A*, and 1*B*, 5*B*, can be assumed or determined by the conditions of the machine, but their differences must be equal; that is, $1A - 5A = 5B - 1B$. Connect the points thus found by straight lines, as shown by the full lines which represent continuous cones. The dotted lines represent equivalent stepped cones.

In Figure 5 the steps are all equal. When certain velocity ratios are desired, instead of equal steps, then any diameter between the extremes is found by taking the sum of the first pair, and dividing this by the velocity ratio increased by unity. Thus: If *A* is to make four revolutions on the fourth change, while *B* makes one revolution, then $4A = (1A + 1B) \div 5$. If 5*A* makes six revolutions to one of 5*B*, then $5A = (1A + 1B) \div 7$, etc. Of course, the diameter on the other cone would be equal to the diameter found multiplied by the velocity ratio, viz.: $4B = 4A \times 4$ and $5B = 5A \times 6$, etc. These are very simple arithmetical operations, and can be performed in less time than Figure 4 could be drawn.

LETTERS FROM PRACTICAL MEN.

Portable Electric Light.

Editor American Machinist:

A Mrs. Morey, whether the traditional "Mother Morey" or not is not known, has received a patent from the United States Patent Office for a "Combined Electric Lamp and Generator." The dynamo machine is placed in the case of the lamp, and is to be driven by clock work, also enclosed in the case, while an Edison incandescent lamp is shown above, and the claim is for "a portable electric lamp," etc.

As portable means "capable of being carried," with no necessary limit to the means, and as there can be no doubt that this lamp could be carried, after recent experience with the Egyptian obelisk, it is unnecessary to question the propriety of calling it a "portable lamp," even though its portability may be less than was evidently intended.

Let us see: One Edison lamp of 16 candle power, requires one-eighth of a horse power when in a circuit, but to run a single one, with the necessary friction of the dynamo machine, will require not less than one-sixth of a horse power, or 5,500 foot pounds of force per minute. A spring can be made to lift its own weight one hundred feet, though that is much above the value of an ordinary spring. To run 5,500 foot pounds one minute would, therefore, require 55 pounds in a spring, and for one hour, $55 \times 60 = 3{,}300$ pounds spring, or a *ton and a half* of steel in the base of the lamp, to say nothing of the weight of the dynamo, or the gearing to transmit such a force, which would be considerable.

But this spring would have to be wound up every hour. A good strong workman can exert at his best one-fifth of a horse power, so it would take nine men only *fifty minutes* to wind it up for one hour's run. Truly, the "portable electric light," is "the *greatest* thing of the age," but it does not seem probable that one of this kind will be immediately required in every family.

B.

Fast Melting.

Editor American Machinist:

I saw in your journal Mr. West's article, "How to Melt Iron Rapidly," at the time it was published, but I considered his way of charging a cupola so far behind the age that I did not think it worth noticing. Finally, having a little leisure, I wrote the short criticism which appeared in your issue of December 31, 1881. If, by so doing, I have done Mr. West the honor he claims, I can assure him he is perfectly welcome to it.

In my article, which appeared in the AMERICAN MACHINIST of June 18, 1881, I did not attempt nor intend to give full directions, or any directions, for fast melting, but merely to give an account of those two particular heats. The article was entitled "Fast Melting," and not how to melt fast. Under that title who would expect to find full directions for breaking iron and making up a cupola? For a practical man to see that the results obtained from that cupola were good or bad, will Mr. West please tell us what more notes or hints he would require than a full description of the cupola, tuyeres, blast, fuel and mode of charging?

In my criticism of Mr. West's directions for rapid melting, I said it was not practical to send the melter down into the cupola to arrange the iron, so that a column of coal could be formed in the center of the iron from the bottom to the top of the cupola. Even if this column of coal could be formed in the center, as Mr. West directs, it would not work, for it would take double the quantity of coal, and would only amount to the same thing as the old style of melting, which was to put in a shovelful of coal and a hundred pounds of iron. This style of melting was abandoned long ago, as being too slow and costly.

In this last statement I have made a mistake. I should have said that, with the coal in the center and the iron on the outside, the iron could not have been melted at all, in place of comparing it to the old style of melting.

After reading my criticism of his article, Mr. West endeavored to show what wonderful results he could produce with his mode of charging. The result is, that by putting his iron and coke into the cupola in small charges, he practically adopted the old style of mixing the coke and iron when charging the cupola. After thus abandoning his theory and adopting one more practical, Mr. West succeeded in melting between 7,700 lbs. and 8,000 lbs. of iron with 1,430 lbs. of coke, in a 30-inch cupola, in one hour and nine minutes. Taking his figures for it, he has only melted about 5½ lbs. of iron to the pound of coke. This is the poorest showing I ever saw of a heat, where so much pains had been taken to produce the best possible results.

To give the readers of the AMERICAN MACHINIST an opportunity to compare this with the heats melted every day where the cupolas are properly charged, I have written to three foundrymen where I have melted iron, to send me a statement of a heat melted in their small cupolas, and have received the following replies.*

It is a well known fact that more iron can be melted to the pound of coke than can be melted to the pound of coal; and yet the Weir Stove Company, melting iron for stove plate, melt half a pound more iron to the pound of coal than Mr. West does to the pound of coke. The Eagle Iron Works at Buffalo, and Skinner & Wood, at Erie, when melting a smaller heat than Mr. West did, and melting with coal and coke, melt 2 pounds more iron to the pound of fuel than Mr. West does. The Bay State Iron Works at Erie, melting with all coke in about the same sized cupola, melt 3½ pounds more iron to the pound of coke than Mr. West does. Mr. West's plan may be practical and may not require any extra fuel, but he has hardly shown it thus far.

I have met foundrymen who proposed to melt iron by charging their cupolas with the iron in the center and the fuel around the outside, melting the iron by blowing the heat from the fuel upon it; but Mr. West is the first man I ever heard propose to put the fuel in the center and the iron on the outside, and melt the iron by blowing the heat from the iron upon the fuel.

EDWARD KIRK.

* Mr. Kirk furnishes complete tables as furnished him by the parties referred to, the details of which we are obliged to omit for want of room. We give, however, a summary, and the conclusions which are pertinent to the discussion.

Messrs. Skinner & Wood, Erie, Pa., in a 26" cupola melted 7,100 pounds of iron, producing 5,634 pounds of castings and 1,100 pounds of sprues. The amount of coal used was 540 pounds; amount of coke, 400 pounds: time from commencement of blast to dropping of bottom, 70 minutes. No. 4 Sturtevant fan, 3,100 revolutions. In this heat more than 7½ pounds of iron were melted for each pound of fuel used.

The Bay State Iron Works, Erie, Pa., melted in a cupola, 30" at the bottom and 40" at top, 10,500 pounds of iron with 1,150 pounds of coke. In this instance more than nine pounds of iron were melted for each pound of coke.

The Weir Stove Company, Taunton, Mass., say, as the result of following Mr. Kirk's plan of melting, that they melted 11,000 pounds of iron with 1,775 pounds of coal. Time, one hour and thirty minutes; size of cupola not given.

Taper Reamers.

Editor American Machinist:

In my last I promised you an article on taper reamers. I do not know that I will say anything new on the subject, but will give you sketches of some tools which I believe to be new.

I have had considerable experience with the ordinary method of making taper holes, and I believe that your readers will find the preparing or step reamer, Fig. 1, and the finishing reamer, Fig. 2, to be something new at least, if they do not pronounce them useful, and I believe if any machinist who has occasion to get up a set of tools for reaming taper holes, will make them on the principle I here describe, he will say that they beat the ordinary tools by a large majority.

The full set consists of three tools, besides the first drill (which can be of any of the ordinary forms that will drill a hole true to center) and are:

First, preparing or step reamer, Fig. 1.

Second, roughing reamer.

Third, finishing reamer, Fig. 2.

To make these tools I forge the pieces to the proper size from the best quality of tool steel, and anneal them well. I then center and square up all of them to the same length, countersinking the centers, so that the tail spindle will screw up to same point on each when the pieces are placed between the globular centers described in my last. I then set the tail stock over to the desired taper and turn up all three of them, making No. 2, a trifle smaller than No. 3, and No. 1 a trifle smaller than No. 2; being sure to use a tool of such shape that the cutting point is on the plane of the centers as explained in my last. I use a straight-nozed spring tool, and take a light cut with oil to finish.

After finishing all three to one taper I set the lathe back to straight and a little beyond, so as to turn a slight back taper. I then take No. 1, the preparing or step reamer, and commence with a cut on the surface at the point, and turn it up far enough to leave a step of about $\frac{1}{40}$" to $\frac{1}{32}$", I then run out the tool so as to again commence at the surface of the taper, and turn up another step the same as the first, and so on till I have the piece turned in steps the whole length of the taper.

The back taper is given not only to compensate for the spring of the tool on its increasing depth of cut, but also in order that that the front or cutting end of each step will be just appreciably larger than the back end, for clearance.

After this I place it on centers with a spiral attachment, and mill 3 circular sectioned grooves, or if I have no such rig for milling, I file out the grooves with a round or drill file of the appropriate size, in the manner shown in Fig. 1, so that the angle of the spiral with a circumferential line will be about 60°. I then file back the cutting face of the steps so as to give a good and proper clearance. I chamfer the point back sufficient to give a good cut to follow the drill as shown.

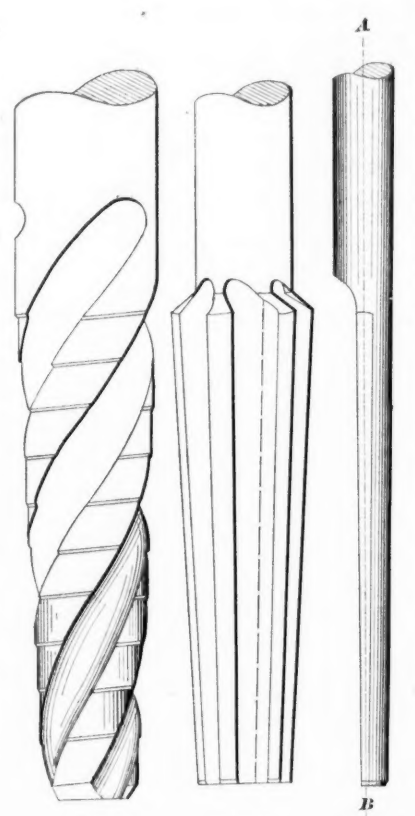


Fig.1 Fig.2 Fig.3

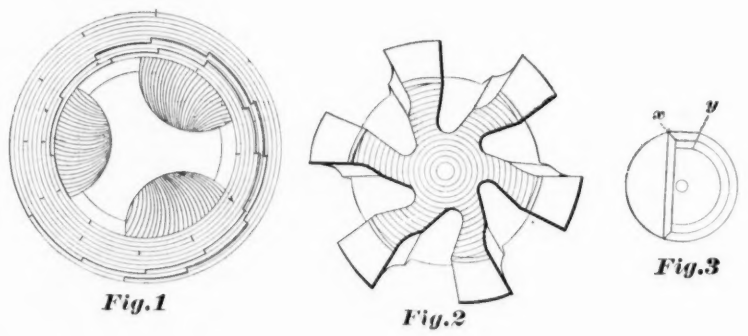


Fig.1 Fig.2 Fig.3

For the roughing reamer, I set the lathe back to same taper that it was turned on, and cut a left hand shallow thread of coarse pitch, say 3 to 5 threads to 1 inch, its whole length, using a tool with width of face equal ⅛ to ¼ of the pitch, I then groove this reamer parallel to its length in the ordinary manner, except that I give an odd number of grooves and coarse, say from 5 to 13, according to size. I space them unevenly so that one tooth will not drop into any depression caused by the preceding tooth. This is an old form of roughing reamer.

The third or finishing reamer is shown in Fig. 2. The form of the flute and cutting teeth is shown in the end view in the cut. It will be seen that the cutting teeth are formed on the same principle as what is known as a spring-goose neck or Whitworth lathe or planer tool, such as used for taking wide, smooth finishing cuts. This form of reamer, if properly made, will not chatter, catch, tear or ringbore; it is easily ground and sharpened, and will (if anything can) make a perfect hole.

I make them with an even number of teeth for the convenience of calipering.

For taper reamers with slight tapers, such as used for dowel pins, etc., I believe the best form is what is known as the half round, shown in Fig. 3. After turning and finishing them to the right size and taper, they should be filed, planed or milled down on one side, not quite one-half the diameter, as far as intended to cut. If hardened in this form, the reamer would not cut; so, in order to make a clearance, it is necessary to flatten the reamer back from the cutting edge to a point below the line of the diameter.

The dotted line *A B* shows the center line, and the end view shows the manner of flattening to give cut. At *x* is the cutting edge, and *y* is the point to which the reamer is flattened for clearance.

While on this subject, I desire to suggest to the American Society of Mechanical Engineers, the Franklin Institute, or some other influential society, the propriety of adopting a standard of tapers for sockets in lathe and other spindles, and to urge its adoption by the tool makers of the country.

At present there are probably no two manufacturers of tools who use the same taper; and in many shops no two lathes, drills, or other tools, are made whose centers, drill collets, etc., will interchange.

I believe every machinist will acknowledge the advantage of having the centers of all the lathes, etc., in the shop (which are of the same class as to size) interchangeable.

In my next I will tell you how I have made chasers for odd screw threads, give an easy method of grooving small taps, and probably say something about tempering taps, reamers, etc. GEO. B. FOOTE

Helena, Montana.

Steam Engine Economy.

Editor American Machinist:

In reference to the question raised by Votre Ami on internal condensation, I want to say a few words. He says, a cylinder having two heads and two piston surfaces, has the least surface in proportion to capacity when the length is twice the diameter, which I admit, but I ask if one cylinder full of steam comes in contact with both cylinder heads and piston faces? I think it strikes only one head and piston surface, or, in other words, for one revolution the steam comes in contact with two cylinder heads and two piston faces, once each, and the surface of the cylinder twice. Formulating this by calculus, we find the minimum surface when the stroke equals the diameter. The thickness of the piston would make no difference if we suppose the condensation to be in proportion to the number of times it is heated and cooled, and not to the time occupied; otherwise, it would tend to lengthen the stroke beyond that stated.

The idea of *H F F*, to reduce the stroke one-half and double the revolutions, has no bearing in this case, because, the question of horse power or speed does not enter. He might be required to run 200 revolutions or more as in a rolling mill, or might be restricted by some releasing gear to 80 revolutions.

The parts and valves of steam engines should be proportioned to the capacity and not to the diameter of the cylinder as at present. The solution of the question of steam engine economy appears to be in the direction of higher pressure, faster speeds and best proportion, and I would respectfully suggest that no engine be entitled to be called "high speed," that does not make at least 200 revolutions per minute.

Syracuse, N. Y. F. R. WILLIAMS.

Steam Engine Economy.

Editor American Machinist:

In your columns of January 28, of this year, appears an article under the above title from Votre Ami, Providence, R. I. Your correspondent finds that when the stroke of an engine is equal to twice the diameter of the cylinder, the ratio of the surfaces within the cylinder to the inclosed volume of steam is the least possible, and therefore, the condensing action of the surfaces upon the volume of steam passed through the cylinder will be reduced to a minimum. The result is correct as deduced from the premises assumed, but these being wrong, the conclusions are incorrect.

His premises are as follows: That a cylinder of a given volume has two cylinder heads, two piston surfaces, and the cylindrical surface, and that this surface is exposed to one cylinder full of steam.

The correct facts are these: That one cylinder full of steam is exposed to one cylinder

head, one piston surface and the cylindrical surface. An eminent engineer expressed it to me in the following happy manner: "The second piston and head surfaces belong to another cylinder, which might as well be a mile away."

The correct result from these premises is, that a given volume will be enclosed by the *least surface* when the stroke is equal to the diameter of the cylinder.

The following rule should be substituted for that given by Votre Ami: To find the diameter of a cylinder and length of stroke for an engine of a given power, multiply the number of horse power by 252,100. Then divide this product by the product of the mean effective pressure, multiplied by the number of revolutions per minute. The cube root of the quotient thus obtained will be the diameter in inches, and also the length of stroke.

Example: 50 horse power. Mean effective pressure 30 lbs., 80 revolutions per minute. Diameter and stroke $= \sqrt[3]{252100 \times 50 \div 30 \times 80}$ =17.38 inches.

DRAG LINK.

New York.

Tests of Belt Power.

Editor American Machinist:

It would be interesting if Mr. H. S. Wilson would give your readers an account of how he measured the driving power of a lathe belt, by means of a tightener pulley, as recorded by him on page 5 of your issue of Jan 28, under the head of "Single and Double Cutting Tools." I think that Mr. W.'s experiment shows that, under the conditions mentioned, it took more power to do the work with two tools than with one, and only await his statement of how his test was made quantitative.

It is a pity that more men of intelligence do not make such tests, as they have an important bearing upon the subject of the cost of a job, and the time required to do it.

Philadelphia, Pa. ROBERT GRIMSHAW.

Cooling Hot Journals.

Editor American Machinist:

A good way to cool hot journals, when pouring water on them is objectionable, is to throw a round belt or rope of a proper length around the shaft close to the journal, fasten the end, and let the loop at the bottom run in a tub of water. It will revolve around the shaft and take enough water along to cool the journal without splashing it all over the shaft.

E. W. THOMPSON.

Thomasville, Ga.

Cooling Hot Journals.

Editor American Machinist:

A little paragraph in one of your recent issues speaking of hot journals, reminds me that a few days ago on the Iron Mountain road I saw a device for allowing water to run on a car journal while the train was in motion, which I was told by the train man was very useful When a journal begins to heat they apply this remedy, and the result is the journal soon becomes smooth and cold.

R. C. MORRIS.

Olney Station, Ill.

Hinges in Split Pulleys.

Editor American Machinist:

I am thankful to Mr. Wm. D. Forbes for kindly pointing out the fallacy of my hinged split pulley scheme, and sorry that he felt called upon to preface his criticism with taffy. I have made too many mistakes in my life to worry much at having them pointed out. Those of your readers who have followed very closely what I have written, will, no doubt, have noticed the many times I have repeated the words "I think," "I believe," etc., and will readily understand that, while what is printed may be read as a statement of fact, very few indeed are the statements intended to be taken as any thing but an expression of my opinion.

Mr. Forbes makes the statement that a pulley made as shown in my drawing "would be worthless." His communication, in my opinion, would be of more value to the young men to whom my paper was supposed to be addressed, if he had given the reason why. A good many of your young readers may be as stupid as myself, and fail to see the point, or refuse to accept his statement without some reason, if not proof.

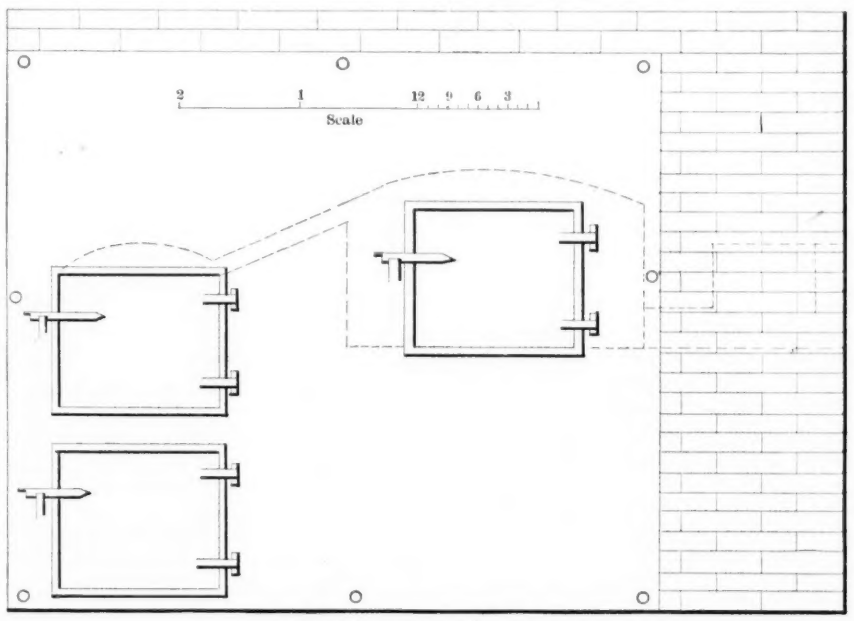
If Mr. Forbes has tried such a pulley and proved it to be worthless, his experience is certainly of more value than the opinion of all authorities. If he has not tried it I do not suppose he knows any more about it than I. I know the pulley would not open so as to go on the shaft, if made as shown, without the gap in the rim, and that is why I made the gap. Why it will render the pulley worthless, or, in fact, why it will be any the less valuable than the common split pulley, more or less offset at the joint, as they usually are, is what I want to find out.

The hinge joint may, however, be made without the gap, as smooth or better than the ordinary pulley, and so it will open to go on the shaft as well.

Any one can satisfy himself as to this by looking at the flat side of a common door butt. The two ends of a cast-iron pulley may be joined as well as the two halves of a cast-iron butt, and the wrought rim pulley can be joined in the same way. In the wrought rim pulley only one joint would be necessary, providing the split in the boss was between two arms, as the rim would spring enough to allow the pulley to be placed on the shaft.

JOHN E. SWEET.

Syracuse, N. Y.



CASE HARDENING FURNACE.

Damascus Blades.

BY THOS. J. BOWDITCH.

While we have been making great discoveries and improvements in the manufacture of steel, it is remarkable that no country can produce an article equal to the Damascus blades which are so celebrated in history; nor has Damascus itself been able for several centuries past to make even a reasonable imitation of the work for which it was so celebrated.

These blades are no myth, as some persons have imagined. They still exist, highly prized in the hands of the descendants of Saracen chieftains and Eastern princes, and are not unfrequently shown in European collections. The peculiarity of the Damascus weapon is not only the beautiful surface, showing myriads of waving zig-zag lines running through the metal, but the elasticity and temper of the steel surpasses all other kinds, combining a sharpness of edge with great elasticity that no modern art can equal. The point of a sword could be bent to touch the hilt, and would spring back to a straight line, and the same sword would cut through an ordinary steel weapon without injuring its keen edge, or would sever a silk handkercheif thrown into the air with equal ease. Scott's story of Saladin's sword in the Talisman is not an invention of the romancer.

Very many and expensive experiments have been made to recover the lost art of making these blades but without success, except in the single instance of General Anosoff, a Russian officer of great ability, who really seemed to succeed in reproducing the old Damascus steel. But even he was unable to do it with sufficient certainty and regularity to leave his discoveries behind him in such shape as to be of practical value to the world. Since his death in 1851, the Siberian works, which he superintended, have failed wholly to produce the required article, and the manufacture of such blades has entirely ceased. His products are well known, and blades of his manufacture are prized in Russia and among the Eastern princes as fully equal, both in beauty and in temper, to the most celebrated of the Damascus blades. But the art does not obey the will of the successors of Anasoff, and at the present there is nowhere in the world a manufacturer of the Damascus blades.

All investigations seem to prove that the Arabs produced their finely-temperered Damascus swords by using two steels of different carbonization, mixing them in the most intimate manner, and twisting them in fantastic ways, but observing method in their fancy.

Nicola Milonas in endeavoring to discover the process employed by the Kourdes in the manufacture of their sword blades, observed: First, that the manufactories in which these blades were made, were situated at the declivity of the mountain, near cascades, the waters of which, falling from rock to rock, arrived in a limpid state in the reservoirs constructed for its reception, and in which the blades are tempered. These reservoirs are themselves placed in situations where the air is very pure. These conditions of purity of air and water are considered necessary for the success of the operation. Second, iron of the purest quality was selected; submitted to a very high temperature. The first tempering is commenced when the iron is at a white heat; the fuel employed is placed on each side of it, and when red hot, the iron is covered as quickly as possible with fatty and oily matter, paste made from bones, wax, etc. This operation tends, according to the manufacturers, to render the blade flexible. The second tempering is performed by the same process, with these differences. The heated iron after having thrown off considerable quantities of sparks, and having been exposed, is covered with a paste composed of powdered bones and purified mutton suet. The third tempering is effected by disposing the metal in such a manner that it may be seized by a man on horseback who rides at full gallop, in order that the blade, which he keeps in an elevated position, may receive the impression of the air. The fuel employed is anthracite and turf. In order to obtain favorable results, it is necessary to use fuel entirely free from sulphur, and to combine as much as possible animal, vegetable and mineral substances.

Imitations resembling the genuine Damascus blades, but far inferior to them in quality, are manufactured at Sheffield, England; Solingen, Germany, and Fiskilstuna, Sweden. These productions have little to recommend them except their name.

From the official balance-sheet of the Paris Exhibition of 1878, just published, it appears that the total expenditures were, in round numbers, $11,155,000 and the total receipts $4,870,000, leaving a deficit of $6,285,000, which is more than three times the original deficit estimate, the estimate having been $2,000,000. In almost every item the expenditures exceeded the estimates, and so also of the receipts. Admissions returned $2,675,000, or $125,000 less than was anticipated. Money paid as wages amounted to $800,000, as against an estimate of only $340,000. Water for the cascades and aquariums cost $560,000, the medals and diplomas $400,000, and the awards ceremony $40,800. Catalogue sales produced $22,000, and the musical performances $14,450.

Case Hardening Furnace.

On this page is shown a front elevation of a furnace for case hardening small articles, which has been used for about fifteen years by the Worcester Machine Screw Co., Worcester, Mass. It has given such good results that two other manufacturing establishments have put in furnaces of the same style, copied by permission from the one here described. Through the courtesy of Mr. A. W. Gifford, manager of the above company, we are enabled to present its details of construction and method of operation to the readers of the AMERICAN MACHINIST. There is no patent and the design is free to all.

The structure used by the screw company is built of ordinary brick, except the walls of furnace and oven and the flues, which are fire brick. It is seven feet wide, five feet high and six feet deep, outside measurement. A cast iron front is fastened on by eight bolts extending through the structure. At the left are the furnace and ash pit, the doors of which are represented in the cut. At the right is shown the oven door. Furnace and oven are each five feet deep. The former is 14″ high and 16″ wide (same size as the door). The latter is 30″ wide and 16″ high (represented by dotted lines). The wall between furnace and oven is a foot thick and is penetrated by four flues, each 4″ wide and 2″ high. The opposite wall of the oven is penetrated by four flues, each 4″ square. These open into a 10″ square flue extending from front to back of the structure (five feet). From the latter flue a 10″ square opening passes through the wall into the opening under the steam boiler. This opening, however, can be shut by a sliding door and the products of combustion thereby directed into the chimney through a flue at the rear.

This company has tried coke, bituminous and anthracite coal for fuel, but has developed the fact, that the best results are obtained by using soft pine wood. The articles to be hardened are put into small cast-iron pots, each resting upon three legs so the heat can reach underneath, and having lugs at the sides to assist in handling. The articles with mixture (equal parts of crushed bone, charcoal and burnt leather scraps) are placed in the pots and covered over the top with a layer of mixture that has been used once. The iron cover is placed over all, but is not luted with clay.

In operation, the flames from the burning pine enter the oven at the top, roll downwards encircling the pots (which are placed in two courses, one above the other), and pass out the larger flues at the bottom of the opposite wall. With coal, a blower was needed, but with soft pine the natural draught is sufficient. The escaping heat enters the boiler furnace on a level with the bottom of fire sheet, thus utilizing the fuel to the fullest extent.

With this furnace, from three to five hours time is required for case hardening, according to size of the articles and the depth it is desired to harden them.

A tank of clean cold water is kept close by the furnace and is replenished as often as used. To obtain the best results, it is necessary to have water as fresh and cold as possible. The pots are taken out of the oven and by aid of a light swinging crane are transferred to the tank, and the articles dumped as quickly as possible into the water. The air should be allowed to strike them as little as possible.

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NEW YORK, FEBRUARY 25, 1882.

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Where there is Safety.

The horrors of railroad disaster a month ago is still bearing fruit in bringing to the surface, in different forms, the never-to-be-abandoned idea of making in some way mechanical appliances superior to the mind that designs them. Numberless plans are advocated, and it is argued for each of them that if adopted, similar accidents would be impossible. Such argument is unobjectionable, except in that it serves to turn attention from the real cause, and from a conception of the fact that there is much more of even an intellectually weak man than there is of the mechanical devices of an intellectual giant. The idea—to put it plainly—of creating *Something* that shall stand out as representative of an individual, and be of itself superior to *men* of other mould, is old, and from its failure—that has been at one time or another productive of a good deal of trouble—the world does not always learn as much as it might. That is, failure in one direction does not seem to qualify men to foresee failure in another direction.

In the proposition to avert railroad accidents by mechanical means, there is more than ordinary resemblance to the advent, a few years ago, of new, and the improvement of existing devices, which were to do away with the possibility of steam boiler explosions. As a matter of fact these devices have always fallen far short of the expectations of their projectors, not because they were not of undoubted value, but because they were believed to be superior to human intelligence.

Every one remembers, not long since, the arguments, based on considerable advances in the production and application of automatic machinery, that the skilled artisan would soon have nothing to do in the industries of the world. Carried to its logical conclusion, the argument would be that inert matter was somehow to be endowed with the reasoning powers of men who had designed its shape and the functions of its parts, and that the only need of human intelligence would be simply a small amount to act secondary to the machine.

These were two instances in the mechanical world where it was argued, inferentially at least, that matter was to demonstrate its superiority to mind. Of the result in the first instance referred to, we hear when we get to the real cause of nine of every ten boiler explosions. Of the second it is only necessary to note that highly skilled and trustworthy workmen are in demand, at good wages, in connection with the best automatic machinery.

There may not be a very apparent connection between the running of railroad trains and the conducting of industrial enterprises, and yet it is more than possible something of interest in relation to the one may be learned from a consideration of the practice in the other. In the latter more reliance is placed on human intelligence than on mere mechanical appliances, or the highest intelligence is demanded in connection with the most improved appliances. In the former the attempt seems to be made to separate the two in the direction of more appliances and less intelligence.

The result is generally as apparent in the instance of railroad collisions as it is in boiler explosions, that some one has blundered—or usually worse than that. The similitude is usually further sustained by the fact, that there may be, and usually is in either instance, an improper action of some purely mechanical device—as the accidental operation of the air-brakes, or the failure of a safety valve—which only argues that mechanical devices, however good, are not to be implicitly relied upon, and that to whatever extent they are multiplied, this fact will never cease to be a fact.

While many so-called safety appliances in connection with railroad travel are valueless, or worse than that, others are of undoubted value, and should by all means be used; but what is of more importance at this time than the addition of further mechanical safeguards, is *better men*, and if necessary, *more of them*, in places of trust. The lives of the traveling public are quite too much at the mercy of those whose pay indicates that they are hired for the brute force they may be able to exert, rather than for any other consideration.

It is foolish to argue, as is sometimes done, that because the labor incident to such positions can be performed by a man of ordinary muscle, that positions filled by men on whose attention to duty the lives of thousands may depend, would not be better filled by men of greater intelligence, and sometimes of more honesty. Men get paid in these times for what they know, and they get paid—unfortunately perhaps—for honest intentions. The world is not yet so full of men who possess the qualifications of ability and strict honesty of purpose, that they will be very generally found occupying positions of danger for twelve or fifteen hours a day, at wages that a man with the ability to use a shovel, and the honesty to use it while he is watched, can readily command. It is not that enough may not be found—sometimes good men—to fill such positions, but there is a standing demand for men with the proper qualification to fill positions of trust to accept better pay for their services.

It is hardly fair to assume that small pay and overwork will make honest men dishonest, and careful men careless, but it is morally certain, that poor pay and overwork will not keep positions of trust filled with the right kind of men. There is a world of pertinency in the remark a few years since, of a heedless switchman on a Western railroad: "What can you expect for thirty dollars a month and fourteen hours a day."

However safety appliances may be multiplied, in affairs where human life is concerned safety lies only in the honest performance of duty by those in responsible positions, and so long as attention is directed mainly to adding new appliances—however valuable they may be—rather than to the putting of the right men in responsible positions, so long will little progress be made.

Compulsory Boiler Inspection Laws.

Daily newspapers hardly ever exercise their persuasive power in favor of laws requiring boilers to be inspected, except when stirred up by an explosion next door or in the immediate vicinity. We have before us an Oil City daily paper of January 27th, giving an account, with startling head lines, of a boiler explosion in that city, which killed one man and severely wounded two others. This is the way it shook up the newspaper office:

Two pieces of iron, weighing nearly a hundred pounds each, crashed through the window fronts, breaking glass, scattering type in all directions, wrecking cases, etc., but fortunately doing no injury to life or limb. Mr. Hummel, the foreman, was struck on the arm by one of the missiles, but was only slightly hurt. A printer had just left his case but a few seconds when another projectile struck it with awful force, crushing it to pieces and throwing the type everywhere. Had he been standing there he must have been terribly hurt if not killed outright. Outside in front of the room adjoining, lay an arm torn and bleeding, a ghastly spectacle, and telling with awful eloquence of the sudden and terrible visitation.

Near the close of the account of this explosion, we are informed that it is proposed to pass a city ordinance regarding the inspection of boilers. "At present," says the journal referred to, "no such ordinance exists, and the accident of to-day has developed the necessity of one." No doubt of it! The editor of that paper is now thoroughly impressed with the importance of guarding, by law, against destruction of life and property from boiler explosions. Under like circumstances so would be the editors of other daily papers. It is all owing to the way the matter is brought to their attention. If some philanthropic engineer should urge a metropolitan daily to agitate the question of compulsory boiler inspection, he would probably be met with a polite refusal, on the ground that the attention of the journal was fully occupied with more important matters, such, for instance, as the discussion of the political situations in Ohio, Pennsylvania and the South, and the chances of certain would-be patriots for obtaining offices at the next election. But let a boiler blow up within reach of their office, smash their types and fixtures, and set the whole force, from editor to devil, dodging for their lives, and the "necessity" of a law compelling boiler owners to have their steam generators inspected suddenly engrafts itself upon their attention.

Yet the danger from unsafe boilers is no greater immediately after an explosion than before it. That danger exists every day in thousands of places, especially where no inspection laws are enforced. In New Jersey, for instance, there are no inspection laws, but plenty of boiler explosions. Two weeks ago a meeting of boiler manufacturers and large steam users was held in Newark, and steps taken to have a boiler inspection bill presented to the State legislature. The press in the principal cites of the State ought to urge the passage of a bill for this purpose. Should their active aid be brought to bear, there could be little doubt about the bill becoming a law.

Among our letters this week is one from a machinist in Pennsylvania oil regions, which gives some light upon the causes of boiler explosions where no inspection laws exist. We give below some extracts from that letter:

"The buyers of steam boilers little know what they are getting from dealers and manufacturers in this oil country. A reliable gentleman told me, not long since, that he had known one firm to buy boilers that were burned until the crown and side sheets bulged out. These they would turn bottom upwards, build a fire in them, and when sufficiently heated, straighten them out with a sledge or jack screw, tar them over and sell them to parties out West or down South. I, myself, have seen them put in leaky boilers, corn meal, saw dust, horse manure and other things, rather than have the boiler-maker chip and calk for an hour. If any of the workmen should proffer advice to have the boiler calked this firm would laugh and say it cost too much, and that they would get nothing more by so doing. Their plan is to get the boiler off their hands with as little cost as possible, selling it at a big figure to some one fifteen or eighteen hundred miles away.

"I have seen old line pipe selected from a pile, cut up and put into boilers for 'flues.' Sometimes a whole set of 'flues' are made in this way and sold for new work. The same firm that fits up and sells boilers of this kind advertises to build new engines. They take an old shaft, turn down the journals, put on a new crank if they have no old crank to fit, and brighten an old connecting rod if the material will admit of it, if not, they paint it and let it go, as 'good enough,' as they say to their men."

The probability is, that a large portion of steam users who patronize such firms as our correspondent mentions, believe they are securing safe and serviceable boilers. It would be useless to tell them that their boilers are dangerous. Nothing but wholesome inspection laws and a conscientious enforcement of them can successfully deal with such cases."

Prospects of the Steam Engine Trade.

Speculation as to the ultimate disposal of all the steam engines being manufactured, bids fair to become as pertinent as the famous querry in reference to pins. A large percentage of the steam engines sold go to replace others, and yet there is no complaint of second-hand engines lying around loose. On the contrary they seem to be taken very readily, with all their presumable defects. In some instances the old engines are removed to make room for others of larger capacity, but in a remarkable number of instances the engines being removed are taken out because they can be replaced by others of a more economical type, and the consequent saving in fuel is sufficient to warrant the change being made. Changes of this kind or for this purpose are common, because as a rule the state of trade has been, and is, such as to place all manufacturers in a condition, so far as means are concerned, to make this change.

But as previously intimated, the engines being removed are readily sold, there being two causes that together operate to create the demand for them. The first of these is that parties want engines faster, or at least on shorter orders, than builders can contract to

furnish, and the second is that at present manufacturing prices it is not so particularly essential to look after the cost of coal.

So long as business remains as at present, the demand on steam engine builders will be good, because users are becoming reasonably well educated up to the advisability of using improved types of engines; that is, the class of buyers named, who buy to secure better economy, will for some time continue to keep up the demand. It is reasonably certain that the demand from this source will not be weakened until profits in manufacturing are materially less than at present, by which time the class who are so readily absorbing second hand engines will be driven by business competition to economize in the matter of their coal bill—in other words, to slide their old engines one degree further down in the scale of users.

Another immediate, and particularly prospective, demand for steam engines, is in the piecing out of water powers. As a rule, in the establishing of any industrial enterprise on the basis of water power, the whole available power is utilized. As time goes on the flow of water becomes less, or at least more irregular, and the water power must be supplemented by steam power; or as is almost universally the case more work is added, and both causes operating together bring about aggravated results. The demand for this purpose is hardly developed as yet. As a matter of fact, the utilization of small water powers in the West, and more particularly in the South, is almost a mania just now, and generally speaking, a water wheel put in today, means the adding of a steam engine in the near future—perhaps at a time when steam engine builders are better able to fill orders than just at present.

Taken altogether, and in connection with the fact, that builders of steam engines were less affected by the stringent times of a few years since, than almost any other class of machine manufacturers, the prospects for the future of the steam engine trade, for some years to come at least, are exceptionally good; not perhaps, for the feverish demand of the past few years, but for a prosperous and healthful business.

We call the attention of our readers who are interested in the matter of the construction or designing of cone pulleys, to the article on page five on this subject. We believe that its conciseness and simplicity will commend itself to them almost at sight.

The *Sewing Machine News*, judging from its last issue, is determined to keep up its reputation for furnishing in a particularly readable shape, just the news its readers are looking for. Each succeeding number of this journal is the "best."

Congressman R. P. Flower, of New York, has our thanks for a copy of the Report of the United States Commissioners to the Paris Universal Exposition of 1878. These are five large bound volumes with copious illustrations. It has taken a long time to get this report ready for sending out, but perhaps the delay has been necessary. We have not had time to look through these volumes, therefore we cannot yet pass any criticism.

LECTURES IN A WORKSHOP, by T. P. Pemberton, is the title of a neat little volume just issued by the Industrial Publication Company, 14 Dey street, New York. The preface declares the lecture to have been written "with the aim of stimulating young men and workmen to self culture, and of showing them in plain language the unprecedented and splendid opportunities and means for education and improvement." The "course" is philosophical throughout, and will prove interesting to those who enjoy reading or hearing lectures.

The *Industrial Review*, a new monthly published at Atlanta, Ga., and Philadelphia, Pa., comes to us neatly printed on good paper. It contains much matter of interest in relation to the late exhibition at Atlanta, as well as many other things relating particularly to that part of the country which it aims to represent. We extend congratulations, and hope that each succeeding number will be as readable as the present one.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(58) F. H. P., Montpelier, Vt., asks: How can I blue steel without heating? *A.* You can apply nitric acid, and when covered with a thin film of oxide, clean, oil and burnish.

(59) J. C. C., Waterloo, N. J., asks: Will you tell me how to turn a sphere for a pump valve? *A.* See description of a device for this purpose in AMERICAN MACHINIST, Nov. 5, 1881, page 6.

(60) W. E. B., West Quincy, Mass., asks us to name some number of the AMERICAN MACHINIST having a cut showing a pressure plate as applied to a slide valve? *A.* You will find such a valve described in our issue of Nov. 20, 1880.

(61) W. A. C., Wilmington, Del., asks: What metal, liquid or substance, can I use to regulate the temperature of a steam heater for drying delicate substances. I wish to open and close the steam valve automatically? *A.* You can probably use a differential regulator, arranged to open and close a valve by the difference in the expansion of two metals, as iron and brass.

(62) J. A. M., Boston, Mass., asks: Will you tell me the proper clearance for taps, reamers, burrs, etc.? *A.* There is no rule for this. In practice large tools of the kinds named are made with more clearance than smaller ones, and in most instances the matter is one of individual judgment. Usually very little clearance is required on such tools, and an excess of clearance is generally a disadvantage.

(63) J. W., Elkhart, Ind., asks: What is the arrangement used in a locomotive smoke stack to prevent throwing fire, and is there any patent on it? *A.* The more common device is a cast-iron cone placed nearly at the top of the stack, against which the sparks strike, and are broken up and deflected downwards. In addition to this, the top of the stack is covered with wire netting. There are no patents on such an arrangement. There are, however, several so-called patented spark arresters.

(64) J. B. S., York, Pa., asks: Which has the most friction, a 3¾″ shaft running in a box 6″ long, or the same shaft running in a box 9″ long? *A.* It would depend on the amount of pressure forcing the shaft towards contact with the metal of the box, also on the metal of which the box and shaft is composed. If the pressure was quite light, the friction would probably be slightly less with the short box, but, on general principles, the long box would be the best.

(65) W. E. C., St. John's River, Florida, writes: I want to ask your advice in reference to a matter, which is this—I propose to put a pipe or pipes in the furnace of my boiler, running between the grate bars, and connecting at one end with boiler legs, and at the other with steam room of boiler. I think by this means I will assist the circulation, and will be able to get up steam in less time. What is your opinion of the project, and what kind of pipe would you advise me to use? *A.* As we understand you, the pipe would take the place of some of the grate bars, in which case the air as it entered the furnace would come in contact with one side of it, while the other side being in contact with the fuel would rather tend to retard combustion than otherwise. We do not see why it would materially improve the circulation, although it might do so to a slight extent. You could use common wrought iron pipe.

(66) W. G. R., Baltimore, Md., asks: 1. Would you please inform me of a correct method for finding right size or pitch of verge, suitable for a pendulum whose length is known; or, when pitch or size of verge is known, to find correct length of pendulum rod from verge to bottom of pendulum ball? *A.* So far as we know there is no rule applicable to the above. 2. How shall I restore small brass articles that have become tarnished? *A.* You can use the following solution: 1 ounce sulphuric acid, ¾ ounce nitric acid, ½ drachm saltpeter and one ounce of rain water. Mix thoroughly, and let stand for five hours. Dip the article to be cleaned in the solution, immediately wash in rain water, and dry in sawdust. 3. What should be the proportions of a pump to test gauges of a high pressure? *A.* The pressure against the plunger of pump will be the same per square inch of section as that on the gauge you are testing; hence you must calculate the area of piston and leverage of the pump lever, so you will be able to work the pump. For instance, if the plunger was ¼″ area, and you were testing a gauge to 4,000 pounds with 10 leverages, you would have to exert a force of something more than 100 pounds. Further than this, it will be necessary to use strong check valves, and make the barrel of pump strong enough to stand the pressure.

BUSINESS SPECIALS.

Transient advertisements 50 cts. a line for each insertion under this head. About seven words make a line. Should be received Wednesday morning.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O.

Presses and Dies. Ayar Mach. Works, Salem, N. J.

Alfred Wilkinson, Expert Tests of Steam Engines and Boilers, 123 N. 4th St., Phila.

List of Machinists in U. S. and Canada; just compiled. Price $10. A. C. Farley & Co., Philadelphia.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

"To stop leaks in Boiler Tubes use Quinn's Patent Ferules. Address, S. M. Co., South Newmarket, N. H."

Mechanical drawings, machine designs, tracings and Patent Office work. A. J. Emery, Mechanical Engineer and Draughtsman, 58 Liberty Street, N.Y.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Book sent free by the publisher, Jas. F. Hotchkiss, 84 John Street, N. Y.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

"Slide Valve Gears," by Hugo Bilgram, published by E. Claxton & Co., Phila., describes the easiest method known for correctly proportioning slide valves, link-motions and cut-off gears; price, $1.00.

The J. N. Mills Publishing Co., 165 Broadway, N. Y., publishers of Steam Users' Business Directories for the New England States, 1880, New York and New Jersey, 1881, have in course of preparation their edition for PENNSYLVANIA and OHIO for 1882. Intending subscribers or advertisers for above work please address us early for circular and prospectus.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, neatly bound in cloth, ready to ship by express, for four dollars. Unbound, three dollars. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Useful Information for Steam Users." A 100-page *Illustrated Pamphlet*. Contains interesting data on the care and management of Steam Boilers, and rules for engineers and firemen. Engineers everywhere should have this work. Sent for 25 cents in P. O. Stamps. The J. N. Mills Publishing Co., 165 Broadway, N. Y.

Ealy's "Blue Book,"—Special classified list of Machinists, Machinery, Railway, Engine and Boiler Makers supplies, etc., with financial standing and paying qualities of all dealers and manufacturers. Much more convenient and reliable than any other work of the kind published. We also furnish full detailed written reports. Price $30 to July 1, 1882. The JOHN W. EALY COMPANY, 51 Chambers street, New York or 79 Dearborn street, Chicago, Ill.

THE SANITARY ENGINEER contains in the issue of Jan. 26, 1882—Illustrations with full descriptions of the remodeled Drainage of the White House; an illustrated article describing the Heating of Elevated Railroad Cars by steam supplied from the Locomotive; also, in other respects, it is an exceptionally interesting number. Single copies, 7 cents; can be obtained through newsdealers. Terms, $3 per year, in advance. Published every Thursday, at 140 William Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 Humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

The publishers of the Engineering and Mining Journal will issue January 4, 1882, and each Wednesday thereafter, COAL, a weekly journal, to be devoted exclusively to the interests of the coal trade, including: 1. The mining and preparation of coal for market. 2. Its transportation. 3. The marketing of coal. 4. The economical use of coal. COAL will be profusely illustrated, and the freight, labor and wages questions will be treated in a thorough and popular manner. The statistical information of COAL will be collected with great labor and care, and will give the current production of coal throughout the country. COAL will be conducted by gentlemen of ability and great experience in every department of the coal trade, and will have, at the outset, a large staff of reliable correspondents at the different coal centers of the country. Subscription price, $2 per year. Specimen copies on application. Address The Scientific Publishing Company, 27 Park Place, New York. P. O. Box 1833.

MANUFACTURES.

The Boston Blower Company are to erect a three-story building at Hyde Park, Mass.

D. H. & J. C. Newton will soon commence the construction of a paper mill at Hartland, Vt.

There is talk of the formation of a new company at Fall River, Mass., with a capital of $50,000 to manufacture boilers.

The Illinois and St. Louis Railway Company contemplate the erection of an elevator at East St. Louis in the Spring.

The Rodney Hunt Machine Company's works, recently burned at Orange, Mass., will, it is said, probably be rebuilt.

The Brattleboro, Vt., Sewing Machine Company are anticipating changes that will increase their working force and their output.

The Palmer, Mass., Wire Company, recently incorporated with a capital of $50,000, will erect works about one mile from the village.

The Stow Flexible Shaft Company, Philadelphia, Pa., have taken the agency for the goods of the Chicago Rawhide Manufacturing Company.

The Platt Mill Company, of Waterbury, Conn., have commenced the construction of an elevator at that place, to be on the Chase plan.

The Oliver Wire Company, Pittsburgh, Pa., are making additions to their works, with the intention of increasing the output to 100 tons per day.

The Dallas Car and Agricultural Implement Company, of East Dallas, Texas, write us that they are building new shops, and are prepared to order machinery for the same.

The Link Belt Machinery Company, of Chicago, Ill., have recently purchased land on which they will erect a foundry 50x100 feet, and a machinery building 50x176 feet.

The Consolidated Safety Valve Company, Boston, Mass., are enlarging their floor space and adding new tools to meet the increased demand for their products.

The Massasoit Manufacturing Company has been organized at Fall River, Mass., with a capital of $50,000, for manufacturing cotton fabrics and for preparing cotton waste.

The Brayton Petroleum Engine Company, East Bridgewater, Mass., are rapidly putting their buildings into shape, and will soon give employment to fifty men. The tools were furnished by Hill, Clarke & Co., of Boston, Mass.

Geo. V. Hecker, New York, after using the Mahony Corrugated Grate Bar three years in his flouring mills, has decided to adopt the Mahony Bar, and will have them put in all of his boiler furnaces, which number about 25.

Ritchie & Dyer Co., Hamilton, Ohio, say they have been driven for the past year on Ritchie Road Engines, and saw-mill machinery. They will enlarge their works to keep up with orders, which are now four months behind.

Ralph R. Osgood, who has been for some years engaged in manufacturing dredging machinery at Troy, N. Y., has associated a partner with him in the business. Their business address is Osgood & Macnaughton, 37 State Street, Albany, N. Y.

It is stated that the officers of the Maine Central Railroad have voted to accept the proposition of the City of Portland, in offering them at a normal rate, for a term of twenty-five years, the lease of the powder-house lot and flats for the use of their machine shops.

George C. Howard, 17 S. 18th Street, Philadelphia, Pa., writes us he has been fully employed the past year in the manufacture of elevators, automatic hatch covers, machinist tools, paper, cotton, wood and worsted machinery. He has orders for four months in advance.

In a test of two of the Bate Duplex Steam Generators at the Blantyre Mills, Manayunk, Pa., an evaporation of 11.34 pounds of water into dry steam per pound of coal was obtained. The test was made by, and the statement made on, the authority of A. Wilkinson.

The Ottumwa Iron Works, of Ottumwa, Iowa, are building a pair of 80 horse power double coal hoisting engines for the Chicago, Milwaukee and St. Paul Railroad for their mines at Raceville, Ills. This will be the second pair built by this establishment for that company.

The Worcester Machine Screw Co., have recently completed an addition to their shop 100 feet long and two stories high. This gives a floor room of 500 by 36 feet exclusive of basement. At the beginning of the year they were two months behind orders, but the addition is expected to give facilities for catching up.

Some of the stone for the foundation of the Chicago Locomotive Works at Garfield, Ill., has arrived, and other material has been shipped. The company will shortly advertise for bids for the construction of their buildings, machinery, etc., and hope before many months to be letting out locomotives.

The Cincinnati, Indianapolis, St. Louis & Chicago Railroad Company have taken steps to secure the building of a large grain elevator at Cincinnati. The house will have a storage capacity of 600,000 bushels, and cost fully $150,000. The present elevator owned by the road at Cincinnati will be torn down to make room for the proposed Union depot, hence the necessity for the new elevator. A Chicago architect will supply the plans.—*Industrial World.*

The Ohio Powder Company was organized at Youngstown, Ohio, Jan. 28th, and the following officers elected: President, Joseph H. Brown; Vice President, Olin Scott; Secretary, W. A. Beecher; Treasurer, Edwin Bell; General Manager, E. L. Brown.

The company will immediately commence the erection of extensive works, of which Col. Olin Scott, of Bennington, Vt., will be engineer in charge.

Wm. T. Bate & Son, Conshohocken, Pa., are now making 5 of their Steam Generators, each 80 horse power, for Alexander Balfour & Co.'s new paper mill, Philadelphia, additional to one of the same kind put in about a year ago. They are also making a 125 horse power generator for John B. Nelson's cotton mill, Philadelphia, same size as the boiler furnished him 2½ years ago. Also putting in for James W. Wright, cotton warp mill, Philadelphia, an 80 horse power; James Winpenny, Manayunk, 65 horse power, same as one put in six months ago; and for the Tyrone Paper Works, Tyrone, Pa., one of 80 horse power constructed to carry 125 lbs. pressure.

Machinists' and Engineers' Supplies.

NEW YORK, Feb. 9, 1882.

The condition of the supply market during the past week appears to have been satisfactory to dealers. But sales are restricted because of the delay upon the part of the manufacturers in filling their orders. It is very difficult to fill orders promptly. Those who are badly in need of goods are offering a slight advance upon orders for early future delivery, which has placed the productions of the manufacturers under engagement for some time to come. Prices are firm with a greater probability of rising than of falling.

The American Screw Co. have issued a new price list in which they make the announcement that they are now manufacturing two hundred and eighteen varieties of screws instead of only sixty-three as formerly.

Iron and Metal Review.

The Pig Iron market remains quiet, but firm with the demand and supply about equally balanced.

There has been no diminution in the volume consumed, and none is apprehended at present. We quote Foundry No. 1 at $26.50 to $27.50; Foundry No. 2 X, $24.50 to $25; Gray Forge, $23.50 to $24. The market for Foreign Iron is quiet, but firm. Large buyers have secured the bulk of the shipments for this month at special freight rates.

We quote Gartsherrie at $26 to $27; Coltness, $27.50 to $28; Glengarnock, $25 to $25.50; Carnbroe, $25; Eglinton, $24.50 to $25; Summerlee, $26.50.

Prime Wrought Iron Scrap in moderate demand, at $32.50 to $33 from yard. Merchants' Bar Iron is quiet, in view of an expected advance in prices.

Steel and Iron rails quiet with no change in prices. Old rails firm but quiet at $30 to $31.50 for Tee's, and $32 for Double heads.

The Copper market continues dull. We quote Lake Superior at 19¼c. Banca Tin, 26c. to 26¼c; Straits and Malacca, 25c. to 25¼; Australian and Billiton, 25c.; Spelter, Western, 5¾c. to 6c. Refined, 8c. to 8¾c. Silesian, 5¾c. Lead, 5¼c. Antimony, 12¾c. to 14¼c.

WANTED

"Situation and Help" Advertisements, 30 cents a line, each insertion. About seven words make a line. Should be received Thursday morning.

A Mechanical Draughtsman desires re-engagement. Address "H," P. O., D. 38, New Haven, Conn.

Pattern Maker Wanted—A good workman, if a steady and reliable man, can find a good situation with the Concord Axle Co., Fisherville, N. H.

A Draughtsman familiar with the erection of pumping machinery desires a position. Best references. Address, P. O. Box No. 85, Media, Douglas Co., Kansas.

Brass Finisher—To good active lathe hand steady employment. Good wages. Healthy, pleasant and cheap city to live in. Waterous Engine Works Co., Brantford, Canada.

Wanted.—Foreman of iron foundry desires a situation; has had experience, and can bring good recommendations. Valve work a specialty. Address Box 4, AMERICAN MACHINIST.

Wanted—Foreman for Machine Shop; must have experience and capacity to handle one hundred men, accustomed to Engine work and shop regime. References required. Address, A. W. H., Middletown, O.

Machinist Wanted—A rare chance, if applied for soon, for a first-class, thorough going, practical machinist, with from $1,500 to $3,000 capital to invest. Address, W. E. S., BOX 1, AMERICAN MACHINIST Office.

Wanted—Young man to take charge of machine shop (light work) in a manufacturing concern very near New York. Must be one who has been educated in a modern shop, and who is quick, sharp, intelligent, systematic, and a driver. Address "Disciplinarian," Box 13, AMERICAN MACHINIST office.

Wanted.—To purchase a good Engineer's Transit must be cheap for cash. R. S., 206 East 50th St.

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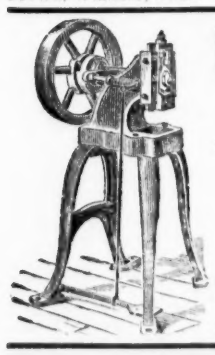

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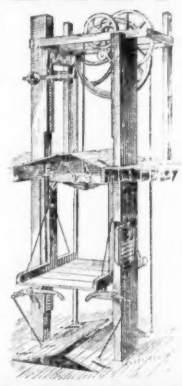

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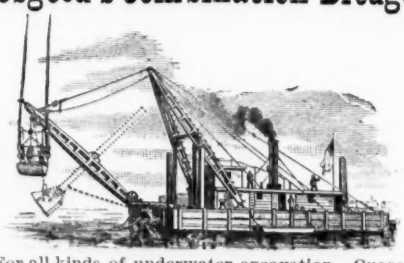

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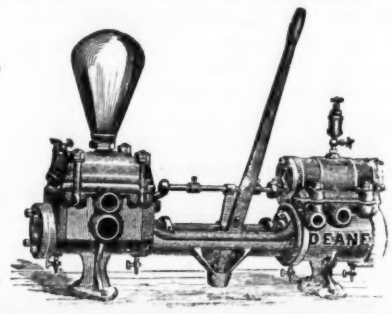

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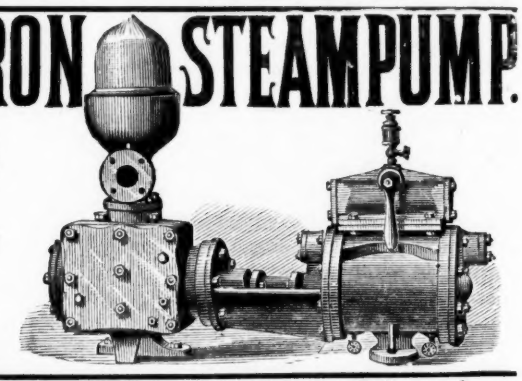

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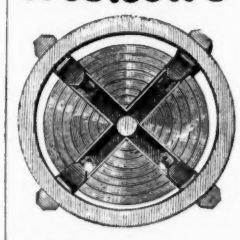

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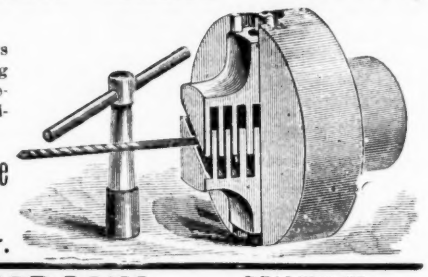

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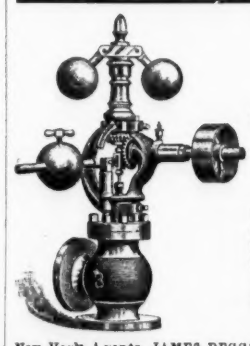

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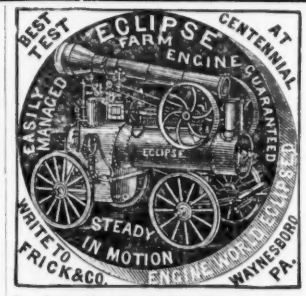

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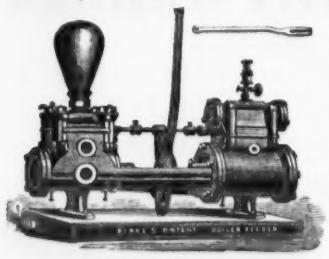

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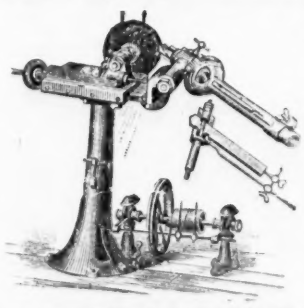

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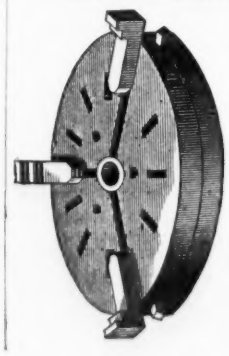

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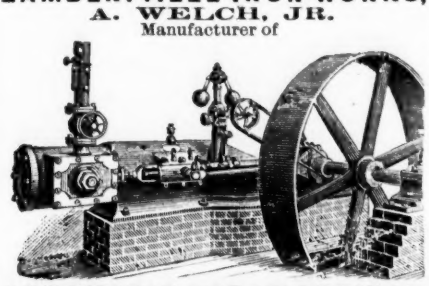

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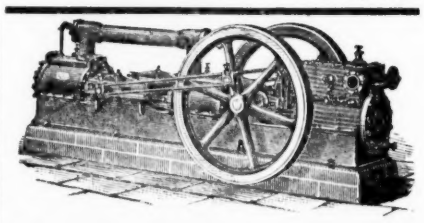

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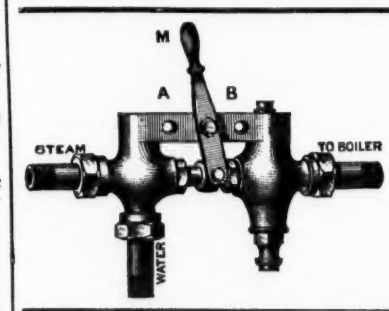

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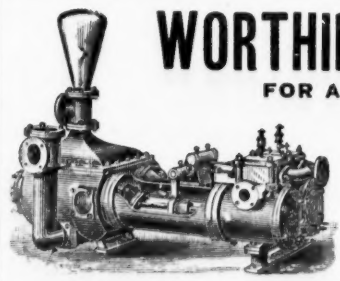

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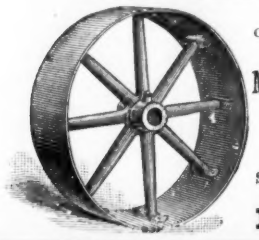

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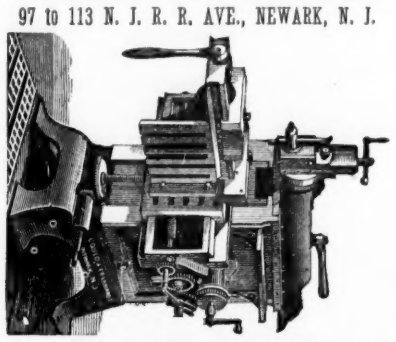

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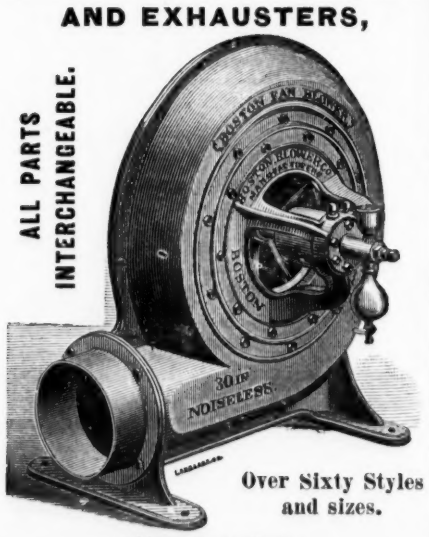

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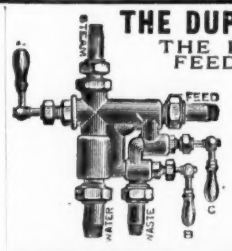

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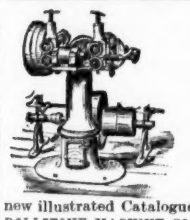

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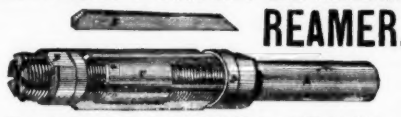

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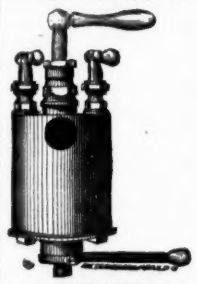

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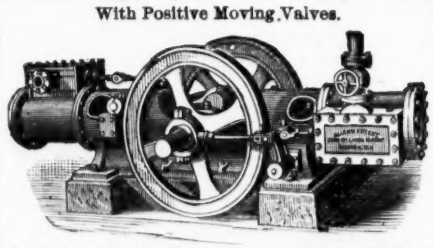

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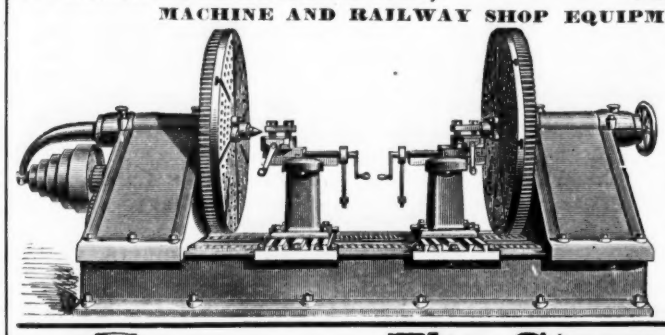

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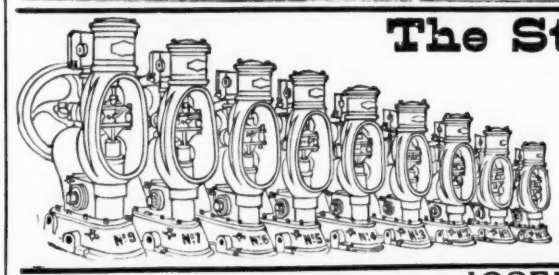

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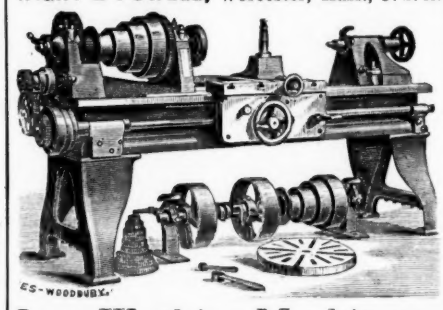

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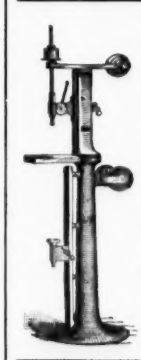

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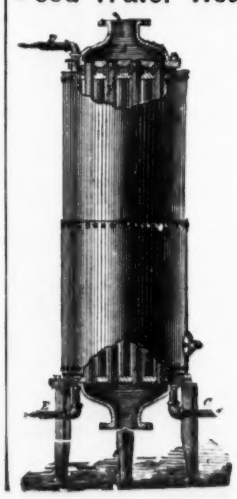

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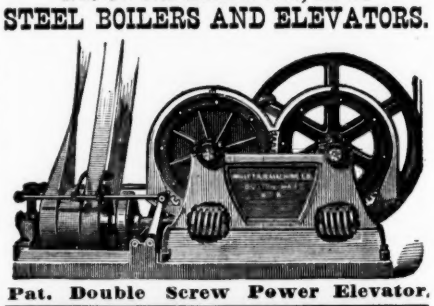

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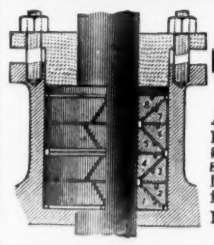

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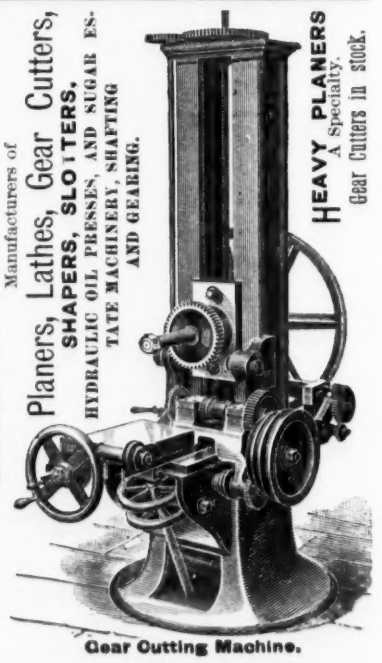

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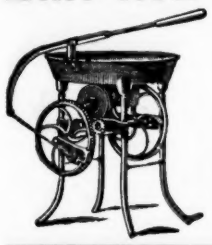

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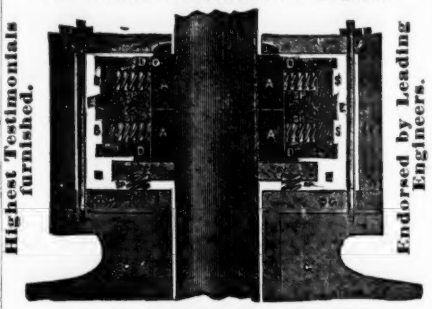

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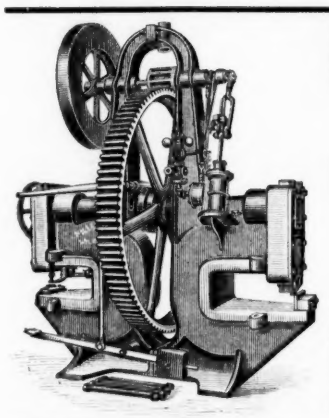

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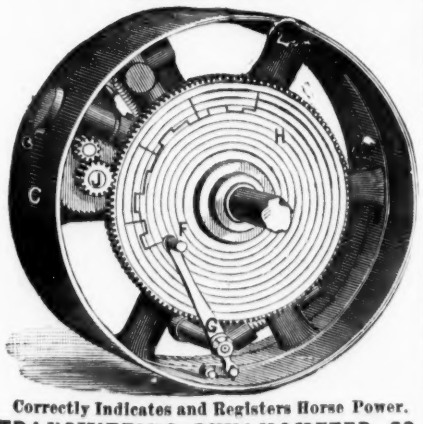

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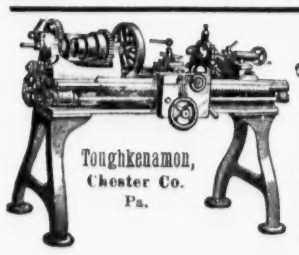

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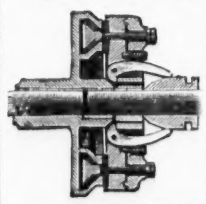

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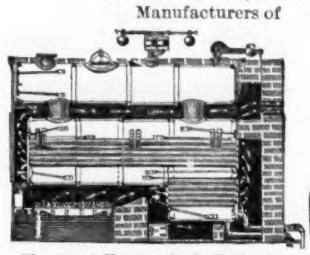

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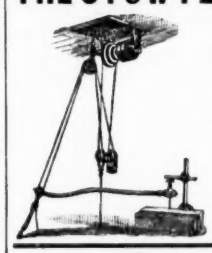

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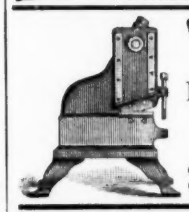

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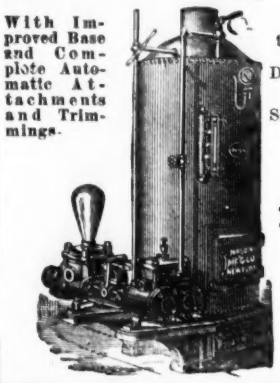

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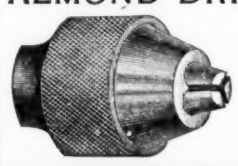

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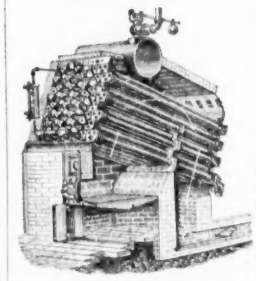

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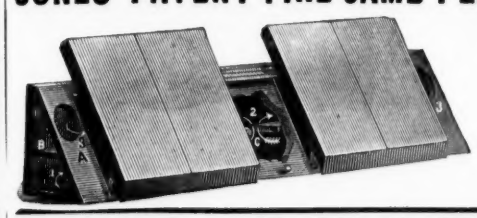

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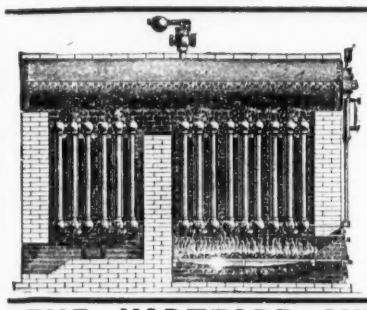

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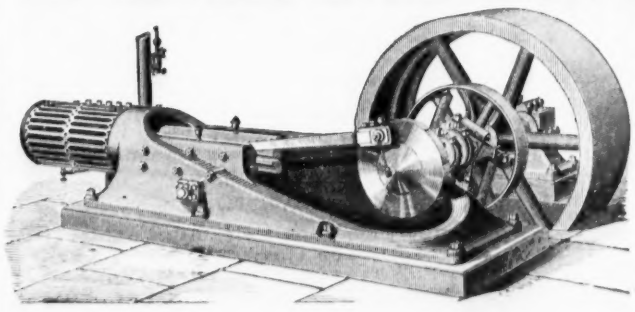

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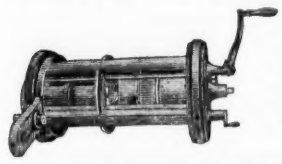

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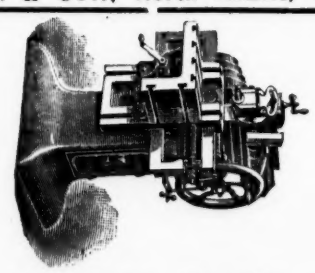

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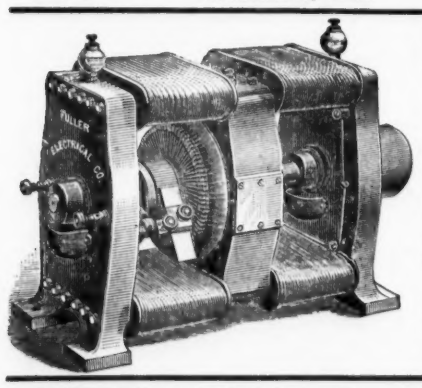

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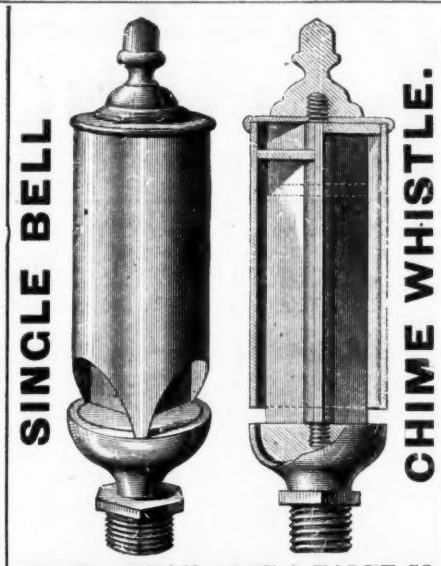

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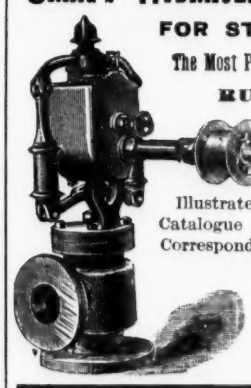

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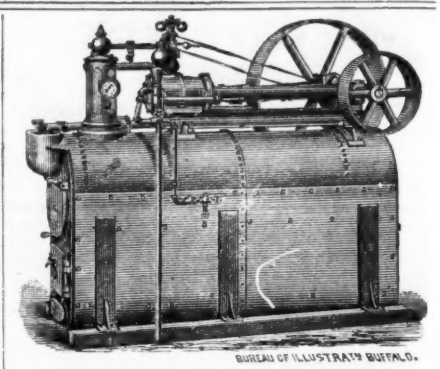

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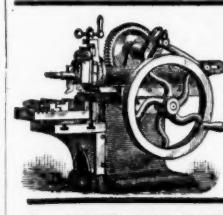

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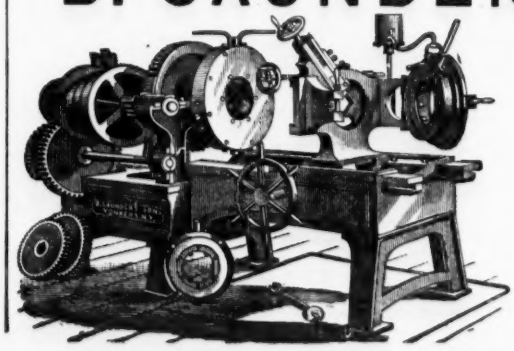

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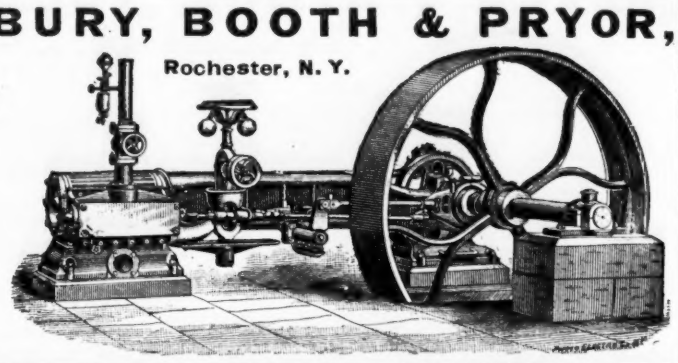

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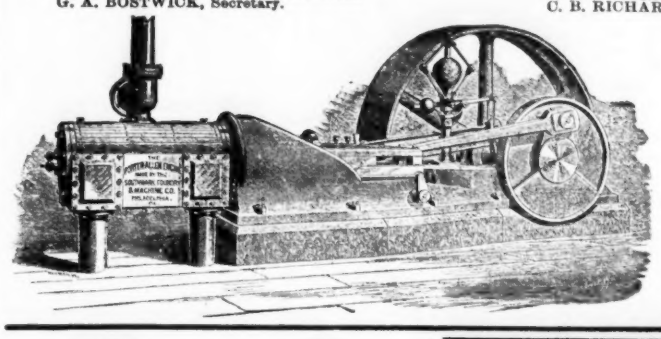

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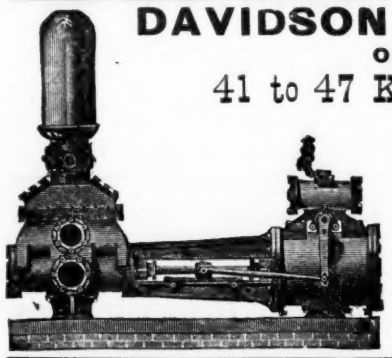

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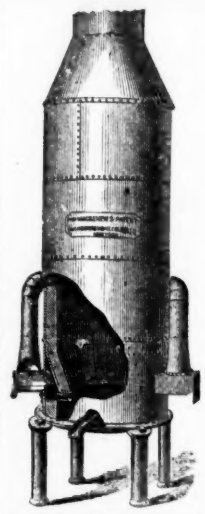

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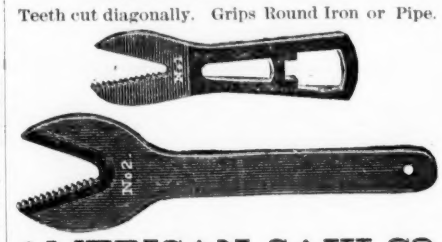

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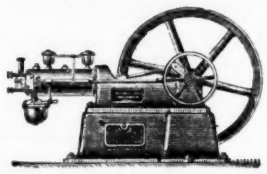

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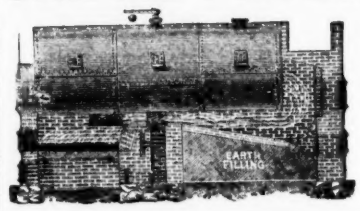

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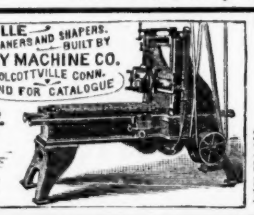

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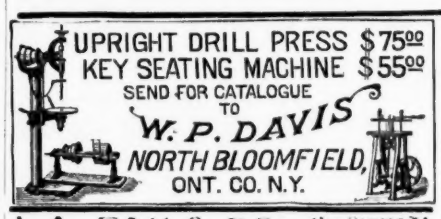

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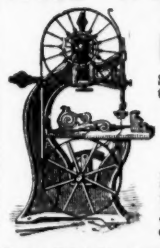

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2	26 in. x 26 in. x 6 ft.	"	"	"
2	30 in. swing, 15 ft. bed.	Engine Lathes.		February.
1	22 in. swing, 13½ ft.	Bed Engine Lathes.		"
3	18 in. " 10 ft.	"	"	"
3	18 in. " 8 ft.	"	"	"
2	30 in. "	Upright Back Geared Drills.		"

The following in store:

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1	19 in. " 6 ft.	"	"	2d-hand.
2	19 in. " 10 ft.	"	"	New.
2	19 in. " 8 ft.	"	"	"
3	18 in. " 8 ft.	"	"	"
2	15 in. " 5 ft.	"	"	"
1	17 in. " 6 ft.	"	"	2d-hand.
1	17 in. " 7½ ft.	"	"	"
1	15 in. " 15 ft.	"	"	"
1	1¼ in. " 4 ft.	"	"	"
1	21 in. " 10 ft.	Bed Turret Head Lathe.		
1	15 in. " 9 ft.	Hand Lathe.		New.
3	12 in. " 6 ft.	Bed Hand Lathe.		New.
1	10 in. " 4½ ft.	"	"	"

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1 " " " 4 spindle "
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4 Double-Acting Presses, No. 3, nearly new.
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Lot of Forges, 1 Jig Saw, 1 Double Saw Bench, 1 Band Saw, 1 Slat Tenoner, 1 Railway Saw Bench, 1 Foot-power Circular Saw
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One	" "	30 in. x 15½ ft.	New Haven.	
One	" "	28 in. x 16 ft.	Fifield.	New.
One	" "	28 in. x 12 ft.	" "	"
One	" "	27 in. x 17 ft.	B'lyn S. E. Works.	
One	" "	24 in. x 12 ft.	Fifield.	New.
One	" "	24 in. x 10 ft.	" "	"
One	" "	24 in. x 19 ft.	New Haven.	
One	" "	20 in. x 14 ft.	Fifield.	New.
One	" "	20 in. x 10 ft.	Pond.	A1.
One	" "	20 in. x 12 ft.	Ames.	New.
One	" "	20 in. x 10 ft.	"	"
One	" "	20 in. x 8 ft.	"	New.
One	" "	18 in. x 9 ft.	White'b.	Good order.

Three Engine Lathes 18 in. x 8 ft. Jones & Lamson New.
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Three	" "	14 in. x 6 ft.	Star Tool Co.	New
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One	" "	13 in. x 6 ft.	Ames.	New.
One	" "	13 ft. x 4½ ft.		
One	" "	12 in. x 6 ft.	Lincoln.	
Two	" "	11 in. x 5 ft.		
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20 "	"	10 "	"	"	
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21 "	"	10 "	"	Blaisdell.	
20 "	"	14 "	"	Powell.	
24 "	"	12 "	"	Fifield.	
24 "	"	16 "	"	Blaisdell.	
26 "	"	16 "	"	Niles.	
30 "	"	23 "	"	Ames.	
32 "	"	26 "	"	Gleason.	
36 "	"	16 "	"	Fitchburg.	
36 "	"	20 "	"	"	
40 "	"	16 "	"	Gleason.	
50 "	"	20 "	"	Fitchburg.	

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22 in. x 20 in. x 4 ft.	Wheeler.	
24 in. x 24 in. x 6 ft.	Hendey.	
24 in. x 24 in. x 6 ft.	Whitcomb.	
26 in. x 24 in. x 6 ft.	Gleason	
26 in. x 24 in. x 7 ft.	"	
24 in. x 24 in. x 8 ft.	Ames.	
26 in. x 26 in. x 8 ft.	Pond.	
27 in. x 27 in. x 8 ft.	Whitcomb.	
28 in. x 28 in. x 6 ft.	Gleason.	
28 in. x 28 in. x 8 ft.	"	
30 in. x 30 in. x 8 ft.	Whitcomb.	
30 in. x 30 in. x 8 ft.	Fitchburg.	
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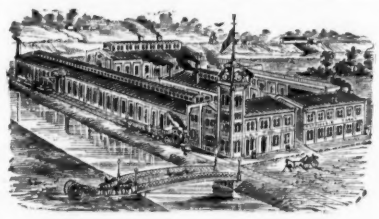

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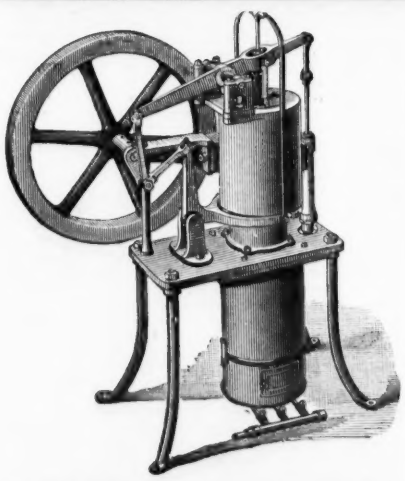

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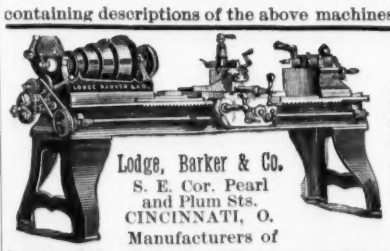

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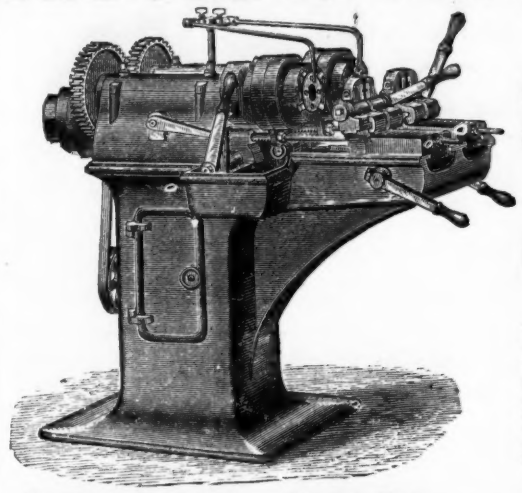

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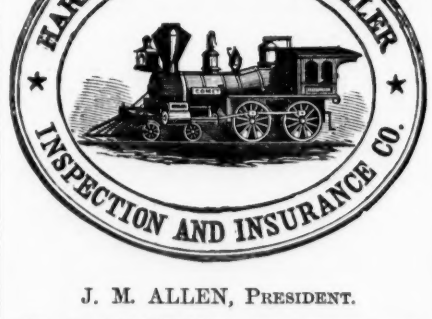

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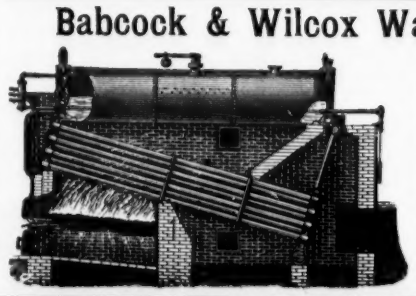

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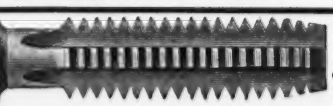

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